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ABSTRACT

This teacher's guide, one of nine teacher packages developed for use in the sequential, hands-on, field-oriented, K-8 environmental education program of the Martin County Schools in Florida, was developed for use with elementary children in grade six prior to and after a visit to an environmental studies center located near an estuarine area. The grade six program centers around the theme "River Investigations" and includes the use of a survey boat to investigate the siltation of a river bottom, changes in salinity, and other factors of the estuarine ecosystem. This guide contains teacher instructions, scripts, tests with keys, and a copy of all student materials. Three slide/tape programs are not included. General and specific program objectives are stated and a program outline, including learning activities to be completed at the school and environmental studies center, is detailed. (BT)

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6th Grade

River Investigation

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SE 022 821

Martin County Schools'
ENVIRONMENTAL STUDIES CENTER
2900 NE Indian River Drive, Jensen Beach, Florida 33457

TABLE OF CONTENTS AND CHECKLIST

This packet contains teacher instructions, scripts, test with answer key and a copy of all student materials.

We suggest you cover these materials in the order listed in this packet.

In parenthesis after each item is the quantity you will need for your class and whether it is expendable or to be returned.

* Also listed but not included in this booklet are items such as flash cards, slide/tapes, feltboard and pieces, etc.

CONTENTS:

1. Program Summary
2. Teacher's Instructions
3. Center Activities
4. Student booklet, "The Physical River" (one for each student-to be returned)
5. Script for slide program, "River Terms, Their Meanings and Relationships"
* 6. Slide/tape program, "River Terms, Their Meanings and Relationships"
7. Student booklet, "Problems" (one for each student-to be returned)
8. Script for slide program, "Problems"
* 9. Slide/tape program, "Problems"
10. Student booklet, "An Indian River Profile" (one for each student-to be returned)
11. Student booklet, "What Is It?" (one for each student-to be returned)
12. Script for slide program, "Equipment"
* 13. Slide/tape program, "Equipment"
14. Student activities booklet, "Puzzles" (one for each student-expendable)
15. Data sheets (will be furnished at the Center visit)
16. Student test (one for each student-to be returned)
17. Test answer sheet with key (one answer sheet for each student-expendable)

SIXTH GRADE PROGRAM SUMMARY

GENERAL OBJECTIVE: To acquaint the student with the physical characteristics of a river as part of his total environment and provide him evidence that he is an integral part of it resulting in his successful completion of the performance activities for the specific objectives.

SPECIFIC OBJECTIVES: The student will on the test:

1. demonstrate with 70% proficiency knowledge of the interrelated physical factors of the Indian River and St. Lucie River ecosystem when given questions pertaining to these factors and a choice of possible answers;
2. select with 70% proficiency possible solutions to environmental problems when given a problem and a choice of solutions;
3. read and interpret with 70% proficiency a chart of a river profile with points representing physical characteristics -- salinity, water depth, temperature, bottom type, etc -- when given the chart and questions about the chart with choice of answers;
4. demonstrate with 80% proficiency knowledge of selected vocabulary words when given a definition or question and choice of possible words.

PROGRAM OUTLINE:

A. Activities at home school (three weeks)

1. "Physical River: What Makes the River Tick?": unit introduction booklet for students
2. Slide/tape program - "River Terms, Their Meanings and Relationships"
3. "Problems?" - a booklet, self-evaluation test & slide/tape program on environmental problems related to the river
4. "An Indian River Profile" - a booklet and a self-evaluation test which prepares the student for his 2-day center and field activity
5. "What Is It? Boat Equipment and How to Use It" - a booklet and slide/tape program
6. Optional material - a puzzle booklet, filmstrips, film loops, books and charts
7. (Visit to the Center)
8. Follow-up discussions
9. Post-test

B. Activities at the Center and in the field - two day program (4-5 hours each day)

1. First day

a. Students divide into 4 groups to work through 4 stations of activities on survey boat.

(1) Measurements: while on the boat each student rotates with his group through the four stations and measures water salinity, depth, turbidity, color and temperature and wind speed.

(2) Sampling: from the boat each student samples the water, bottom type and organisms and bird population.
(3) Recording: all data for each station are recorded on related data sheets.

b. Discussion period follows each activity.

2. Second day

a. Data from previous day's activities are correlated into a river profile.
b. Recording and construction: students construct this profile individually and collectively.
c. Discussion: relationships among the physical factors to the life forms there are developed. Effects of change in these relationships are explored.
d. River grassflat is sampled by seining.
e. Students visit the Wet Lab and Museum at the Center.
f. Students visit the St. Lucie locks for observation and discussion of the function of the locks and the effect of the fresh water discharge on the river.

SIXTH GRADE TEACHER INSTRUCTIONS

INTRODUCTION: The staff at the Center has developed five (5) objectives for the Sixth Grade program. The entire preparation with your students should require three weeks of science class periods. This will vary slightly depending upon the class.

Your visit to the Center will give each student an opportunity to spend one day on the Center's boat and one day to use the data collected while on the boat.

If we can be of any assistance to you in the successful presentation of this material, do not hesitate to call us.

MATERIALS

Booklet and slide/tape summary

1. "THE PHYSICAL RIVER: What Makes the River Tick?"
   This booklet is an overall explanation to the student of:

   a. the river investigation program
   b. the materials he will be using in preparation before he visits the Center
   c. the activities associated with the trip on the river and to the Center

2. "WHAT IS IT?: Boat Equipment and What It Does"
   This booklet is designed to help the student recognize the equipment and use it. There is a tape and slide set that goes with the unit.

3. "PROBLEMS?"
   This booklet introduces the student to problems that have been or can be created or can be due to an altering of the physical condition of the Indian and St. Lucie Rivers. There are five topics:

   a. Mangroves
   b. Grassflats
   c. Polluted River - SLIDES GO WITH THIS UNIT
   d. St. Lucie Lock
   e. Nuclear Power Plant

4. "AN INDIAN RIVER PROFILE"
   This booklet explains what will be done with the data that they collect when they are on the river. Emphasis is on the relationship of the physical factors to one another. How to make a profile is explained by graphs.

5. "RIVER TERMS, THEIR MEANINGS AND RELATIONSHIPS" is a tape and slide set only. The theme is the interrelationship of the physical character of the river and the life it contains.

PROGRAM OUTLINE

OBJECTIVE I - In this objective the student will recognize the interrelationship between the various physical factors or conditions of the Indian or St. Lucie River and the life forms that develop within them.

River Investigation: INTRODUCTION

1. Use the introduction pages in "THE PHYSICAL RIVER" to introduce the unit. Have the student read them.

2. There are questions throughout these two pages. They can be used for a general discussion.

3. This introduction should take one class period.

4. Use the tape and slide set "RIVER TERMS, THEIR MEANINGS AND RELATIONSHIPS". Physical conditions such as "salinity" are presented. Variations in these conditions are discussed. The effect of these conditions upon one another and the life in the river is explained.

5. There are questions throughout the slide program. These are to be used for a review of this section.

6. To help the student tie together interrelationships of physical factors to the total environment, have him proceed to the introduction of "PROBLEMS?" The effect of alteration of physical conditions is introduced.

7. Two (2) class periods are suggested for this objective.

Recommended Supplementary Material

Books:

a. Life of the Seashore by Amos
b. Life of the Marsh by Niering
c. Life and Death of the Salt Marsh by J & M Teal

Film Loops:

a. Seashore - Plant & Animal Adaptations
b. Mangrove Swamp: Food Web

OBJECTIVE II - In this objective each student will study recognition of environmental problems and project solutions for specific problems.

1. The students will probably need at least three (3) classroom periods.

2. Each student should have the "PROBLEMS?" booklet. As you will note each of the five (5) topics of environmental problems has specific reference material listed at the end of each section. These reference materials will aid in answering the question.

3. The tape and slide set is to be used with the "PROBLEMS?" booklet during the first class period the booklet is introduced.

4. On the last slide there are questions to be answered in a general discussion.

5. Have the students answer on paper the questions at the end of each section of "PROBLEMS?"

6. During the river investigations in the field and at the Center - the lock, power plant, mangroves and grassflats will be visited.

Recommended Supplementary Material

Books:

a. Let's Go - To Stop Water Pollution by Chester
b. Life of the Seashore by Wm. Amos - pp. 130-132; 138-145; 178-179
c. Life and Death of the Salt Marsh by J & M Teal - pp. 156-158; 170-176; 216-217; 253-254
d. Lower Animals, Living Invertebrates of the World by Buchsbaum
e. Water by Time Life Science Library - pp. 175-177
f. Nuclear Power Plants by Lyerly and Mitchell pp. 24-27 (pictures good)
g. Atomic Energy and Your World by Glasston & Thomas - pp. 5-9; 25-26; 40-43; 45; 51
h. Breeder Reactors by Mitchell and Turner pp. 2-3; 42-43
i. Nuclear Terms - A Glossary
j. The Story of Nuclear Power by E. H. Childs
k. Electricity and Man by Isaac Asimov - pp. 26-43
l. Sources of Nuclear Fuel by A. Singleton, Jr. pp. 26-31
m. Nature's Invisible Rays by Jacob Kastner - pp. 13-15; 22; 32-36; 41-42

Film Loops:

a. Mangrove Swamp: Food Web
b. Seahorse
c. Manta and Stingrays
d. Pelican
e. Mollusks
f. Seashore - Plant and Animal Adaptations

Filmstrips:

a. Conserving Our Water

Slides and tapes: from Center

Other:

8 x 10 aerial photos -

8 x 10 aerial photos (cont'd)

a. river showing grassflat
b. seining
c. nuclear plant being built

laminated news item - "Irrigation Outlook 'Best in Four Years'", 10/4/73

16mm film #4 from Instructional Center: "Lakes: Aging and Pollution"
16mm film #105 from Instructional Center: "Controlling Atomic Energy"

OBJECTIVE III - In this objective the student interprets and plots data on a chart when given the physical data.

1. We suggest one to two periods for this objective.

2. Have each student study the "AN INDIAN RIVER PROFILE" booklet.

3. Please go over interpretation and construction of a profile with them as outlined on pp. 3, 4, 5, 6 in their booklet.

4. On a separate sheet of paper have each student take the self evaluation test at the end of the booklet, and correct.

OBJECTIVE IV - The objective for this unit is mastery of a selected vocabulary.

1. There is no separate unit for the vocabulary. At the end of each booklet there is a glossary associated with that particular unit. The two exceptions are:

   a. "WHAT IS IT?" - the vocabulary is throughout
   b. "PROBLEMS?" - the vocabulary is at the end of each topic

   The words are in capital letters and/or underlined.

2. We suggest three class periods for the vocabulary.

3. To stimulate interest use:

   a. a spell down type game such as substituting word meanings
   b. baseball game type activity, and/or
   c. small groups working together

4. As a last activity have each student take the self evaluation test and correct using the answer key.

5. Field trips and discussions at the Center will further emphasize the new vocabulary.

OBJECTIVE V - Students will demonstrate use of field equipment on the boat.

1. Assign the booklet "WHAT IS IT?: Boat Equipment and How to Use It." This will help familiarize the student with the equipment.

2. Slide and tape set of equipment in use.

Objective V (cont'd)

3. Assign the last section of "The Physical River" to acquaint the students with what they will be doing on the boat.

4. The puzzles booklet may be used here or as a follow-up after the Center visit.

. . . .

This concludes the classroom Pre-Activities. You should now be fully prepared for a visit to the Environmental Studies Center. Please let us know which activities were/were not successful, and what activities of your own you may have added. We enccurage you to use current newspaper articles and updated material. After your visit to the Center we suggest at least one day of review before giving the test.

TEST

To post-test your student for your records, copies of the test and answers are included. The test is to be given after your students visit the Center. The test mean for 1974-75 Sixth Grade students completing a full program was 69.9.

SIXTH GRADE CENTER AND FIELD ACTIVITIES

DAY 1 - During the first day's visit the students will participate in an investigation of a river profile.

Before boarding the boat, there will be an assembly to present the day's acitivities and regulations and review the purpose.

The students will be divided into four teams. Each team will rotate through four stations of activities on the boat: the boat will progress across the river, stopping at various locations for the activities. The students of each team will:

At Station A (1) sight and plot the position of the boat on the river
(2) identify birds
(3) check air speed, direction and temperature

At Station B (1) take water temperature and determine the water salinity

At Station C (1) find the river depth and
(2) determine water turbidity and color

At Station D (1) sample and identify river bottom
(2) dredge bottom to examine life and debris

All the data accumulated for each activity will be recorded by each team on data sheets mounted at each station. The entire program will be flexible according to the time factor and general endurance. Lunch will be carried and eaten on the river.

You will participate and be helping the students with the activities at the stations.

At the end of the day, the bus will pick up the students - boat side - and return them directly to their home school.

DAY 2 - The second day at the Center there will be:

(1) Time for changing into clothes that can be worn into water. Sneakers or enclosed shoes are required as a precaution against any river encounter with a sharp object. (This can be living creature or rubbish provided by man.)

(2) A brief assembly (in a Center classroom) to assemble the data, correlate it, and record it on a permanent chart. This will include the actual profile of the river area investigated and the averaging of each team's finding for each investigation at each location along the profile line.

An introduction to the physical and geographical environmental changes along the river and joint projection of the possible results of these changes. These changes include nuclear power plant, dredge and fill, fresh water flooding, various pollutants such as agricultural run-off, etc.

(3) This is followed by a bus trip to a mangrove area and then a quick venture on to a grassflat with seine and dip nets. Students return to the Center, wash down and change into dry clothes. Toward the end of this hour there will be time to visit the wet lab and museum to see the exhibits, aquariums and holding tanks.

Throughout the two days pertinent vocabulary will be continuously used and constant association emphasized among the:

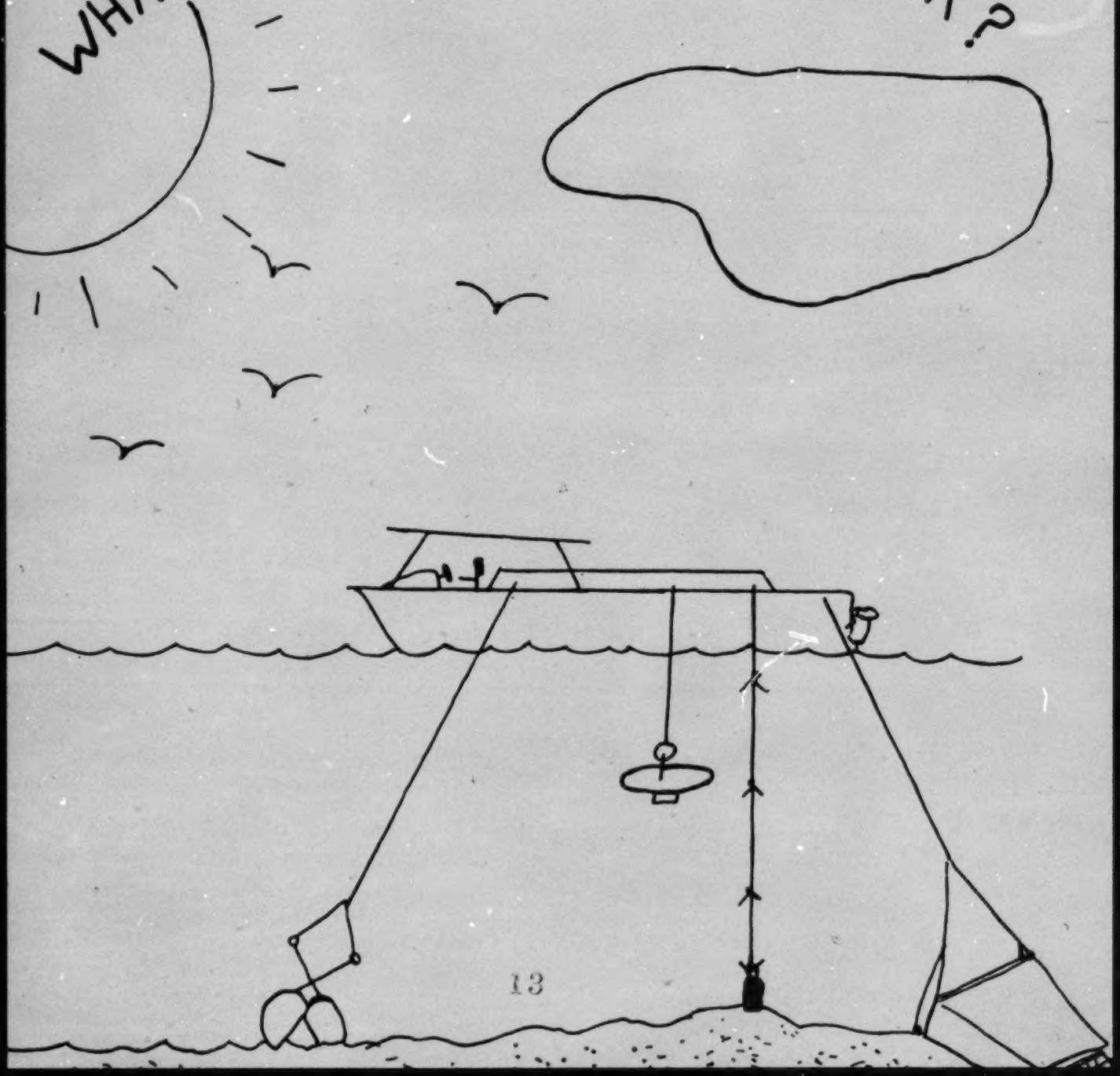
(1) physical characteristics of the river,
(2) life found in the river, and
(3) The individual student's relationship to both.

(4) After visiting the museum and wet lab, everyone will board the bus for a trip to the St. Lucie Locks. There they will eat lunch and tour the Lock area.

Sixth Grade

THE PHYSICAL RIVER

WHAT MAKES THE RIVER TICK?



THE PHYSICAL RIVER

INTRODUCTION:

The Envrionmental Studies Center program you will be involved with is a river investigation. To begin with you will make a PHYSICAL SURVEY of the Indian River LAGOON. Have you any idea what this means?

Let's explain PHYSICAL
The river is controlled by certain CONDITIONS or FACTORS
These CONDITIONS or FACTORS of the river determine:

1. -where the river flows
2. -what it flows by
3. -how it flows
4. -how fast it flows
5. -what the temperture is
6. -how much salt it contains
7. -how deep it is

The PHYSICAL CONDITIONS then, also play a part in determining what plant and animal life will live there.
For example, grasses that make up the GRASSFLATS in the Indian River need:

1. -salt
2. -tropical tempertures
3. -shallow water
4. -sand bottoms
5. -slow currents

At the same time the animals that live in these grasses also need these same CONDITIONS. The MANGROVE trees that are growing along the shores of BRACKISH waters also need certain PHYSICAL CONDITIONS to survive. Can you think of any?

There is much we want you to know about the Indian and St. Luice Rivers before you come to the Center. To help acquaint you we have provided some materials for you to use. You will spend about three weeks of your science class time working on these materials.

They include the following:

1. "THE PHYSICAL RIVER: What Makes the River Tick?"- a booklet.

   This tells you what you do when you visit the center.

2. "AN INDIAN RIVER PROFILE"- a booklet.

   This explains what you will do with all the information you gather while on board the "River Scout".

3. "RIVER TERMS, THEIR MEANINGS AND RELATIONSHIP" - a tape and slide program

   This presents:
   a. terms used while investigating the river on the River Scout
   b. why you are doing some of the investigations
   c. relationships among the investigations (what one has to do with the other).

4. "WHAT IS IT? Boat Equipment and What It Does" - a booklet

   There is a picture of each piece of equipment and its use is explained.

   A tape and slide set is included with the booklet to show you how the equipment is used.

5. "PROBLEMS? Environmental Problems" - a booklet and a tape and slide set

   A discussion of some of the problems that can be or already have been created due to an altering of the PHYSICAL CONDITIONS of the Indian and St. Luice rivers. These include:
   a. Mangroves
   b. Grassflats
   c. Pollution
   d. St Luice Lock
   e. Nuclear Power Plant

There is no separate unit for vocabulary. The vocabulary has been included as part of each unit. You will find glossaries, etc., at the end of unit sections. The vocabulary is one of the most important parts of any study. If you don't know the words or what they mean you have a far more difficult task.

Look for the BOLD type and <u>underlined</u> words. This is your clue to the words you should know.

Now you are ready to begin this unit, "The PHYSICAL RIVER: What Makes the River Tick?"

"RIVER SCOUT"

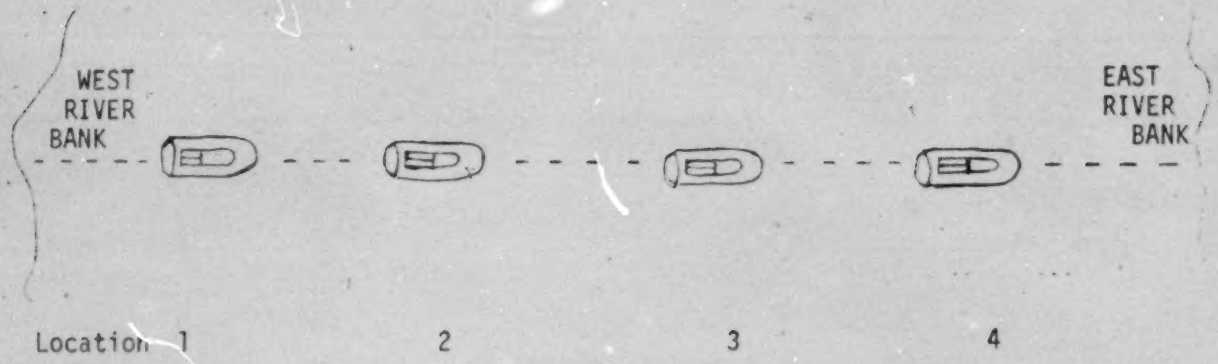
DAY 1

When you come for your first day with the Center you need to bring a lunch and be dressed for a day on the river. This means mud, water, sun, and hard work, because most of your SURVEY of the Indian River will be done from the Center's boat, the "River Scout".

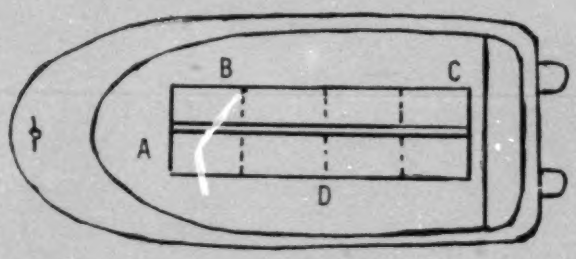
On board the boat are four (4) activity stations. Your class will be divided into four (4) teams. At different locations across the river each team will perform the activities at one of the stations.

The main purpose of the river SURVEY is to develop a PROFILE of the river. A PROFILE shows what the river looks like from the side.

To do this we will stop the boat at different locations across the river.



With the boat stopped, each team will perform one of the activities listed below. When the boat moves to the next location, each team will move to the next station. That way each team will perform each activity before the day is over.



STATION A

1. Sight and plot the position of the boat on the river.
2. Sight and identify various water birds. (Bird Field Guides available at station)
3. Measure the wind speed or VELOSITY.

STATION B

1. Take the water temperature
2. Find the amount of salt in the water (SALINITY)

STATION C

1. Determine the cloudiness or TURBIDITY (from the silt and sand floating in the water).
2. Identify the color of the water.
3. Measure the water depth.

STATION D

1. SAMPLE the animal and plant life as well as DEBRIS on the river bottom before stopping the boat at each location.
2. Identify the type of river bottom at that location (such as sand, mud, or shells or a mixture.

You fill in the information asked for on DATA (information) sheets. These sheets are found attached to the work areas at each activity station on the boat.

After locating these sheets be very sure to read them before you begin the activities. You must know WHAT you are investigating and WHERE to write the information down. Check the top of the sheet to find out what it is for.

BOTTOM DEPTH DATA SHEET

DEPTH SOUNDER

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION

|

TEAM _____

#	DEPTH	#	DEPTH	#	DEPTH
TOTAL		TOTAL		TOTAL	
AVG.		AVG.		AVG.	

Each activity will be discussed before you begin.

The main instruments used to investigate the PHYSICAL CONDITIONS of the river are explained in the "What Is It" booklet.

See if you can match the instruments to the activities for each station on the boat. For example:

1. Which instrument will you use at Station A to sight and plot the location of the boat on the river?
2. For what activity do you use the BOTTOM GRAB?
3. Which instrument will you need to find the SALINITY of the water?
4. For which activity do you need the DREDGE?
5. What does the SECCHI DISC do?

Now why do you think you are doing all these activities on a river investigation? What are you trying to find out?

In what way are surveys of the Indian River or the St. Lucie River important (or related) to you?

To Stuart?

To Martin County?

You will be eating your lunch on the river. At the end of the day your bus will pick you up at the boat's dock and take you back to your home school.

ENVIRONMENTAL STUDIES CENTER

DAY 2

The second day, you will visit the Center itself. You need a lunch and a change of clothes. You should wear clothes you can get wet and some kind of closed shoes like sneakers. You won't be able to go into the water with sandals, thongs, or bare feet.

Why?

What can you encounter in the water?

There will be a brief assembly when you arrive to acquaint you with the day's activities.

First we will go over all the DATA you collected and wrote down on the "River Scout". All this DATA will be compiled into a PROFILE of the area of the river you investigated. How to do a PROFILE of some PHYSICAL CONDITIONS of the Indian River LAGOON is in the booklet, "An Indian River Profile".

After a PROFILE is completed you will begin a discussion about ENVIRONMENTAL PROBLEMS related to the Indian River.

Can you think of any now?

What makes a problem?

Following this you will make a quick trip to an Indian River area to SAMPLE a GRASSFLAT by seining and view MANGROVE trees at close hand.

Why do you think we are going to visit a GRASSFLAT?

Why do we look at the MANGROVE trees? What do these areas of Indian River have to do with ENVIRONMENTAL PROBLEMS?

After returning to the Center you will washoff, change clothes and visit the museum and wet lab. Then you will get on the bus for a trip to the St. Lucie Lock where you will eat your lunch and tour the Lock area.

GLOSSARY

BRACKISH	- water that contains any salt
DATA	- organized information
DEBRIS	- scattered broken remains of something; rubble
ENVIRONMENTAL PROBLEMS	- situations within the surroundings that need solution
ENVIRONMENTAL	- anything to do with surroundings
PROBLEMS	- situations that need solutions
GRASSFLATS	- an area of grass found in shallow waters, deep enough to keep the grass covered
LAGOON	- usually a body of brackish (salted) water that is separated from the sea by a sand bar or coral reef
MANGROVE	- any of the various tropical evergreen trees or shrubs found along the shores reached by the tide
METER	- a unit of length measurement in the metric system equal to 39.7"
PHYSICAL	- dealing with non-living things
PHYSICAL CONDITIONS AND FACTORS	- the characteristics, properties or nature of non-living things like temperature
PHYSICAL SURVEY	- detailed investigation of non-living conditions like river depth
PROFILE	- a side view of something
SALINITY	- the amount of salt found in a certain amount of water
SAMPLE	- a selection or a part of something which then represents it
SURVEY	- detailed investigation
TURBIDITY	- the cloudiness caused by mud or sand particles floating in water
VELOCITY	- the distance something moves in a certain amount of time

Martin County Schools'
Environmental Studies Center
2900 N. E. Indian River Drive
Jensen Beach, Florida 33457

6th Grade Slide Presentation

"River Terms, Their Meaning and Relationships"

TEACHER - Turn projector on to "Focus" slide. Start tape player. Advance slides at the audible tone, or, if you are reading this aloud, as indicated by the asterisk (*). The narrative is in CAPITAL letters.

NOTE: A short review activity is included toward the end of the program. Your students will need pencil and paper at this time. Slides #38-42 require the students to write short answers to the questions posed on the slides. Turn the tape player off at this time to allow time for the answers. The correct answers are found in this narrative but are not recorded on the tape.

1. "Focus" slide *

2. "Credits" slide *

3. "An Environmental Study Unit on River Investigations" * .

4. "River Terms, Their Meaning and Relationships." THIS YEAR YOU WILL BE CONDUCTING A PHYSICAL INVESTIGATION OF THE ST. LUCIE OR INDIAN RIVERS IN MARTIN COUNTY. *

5. THE PHYSICAL FACTORS INCLUDED IN YOUR INVESTIGATION ARE: SALINITY, WIND SPEED, BOTTOM TYPE, TURBIDITY AND WATER COLOR. *

6. WHAT IS A PHYSICAL FACTOR? IT IS ANY CONDITION OF THE RIVER THAT IS NON-LIVING. LET'S DISCUSS SOME OF THE FACTORS YOU WILL BE INVESTIGATING. *

7. LOOK AT THE BEAKER FOR A MINUTE. WHAT PHYSICAL FACTORS ARE BEING MEASURED HERE? YOU SHOULD HAVE FOUND TEMPERATURE, SALINITY, DEPTH, TURBIDITY AND BOTTOM TYPE. *

8. THE FIRST PHYSICAL FACTOR WE WILL BE DISCUSSING IS SALINITY. SALINITY IS THE AMOUNT OF SALT IN A CERTAIN AMOUNT OF WATER. *

9. THE OCEAN'S SALINITY IS ABOUT 35 PARTS PER THOUSAND. *

10. THE INDIAN RIVER'S SALINITY VARIES THROUGHOUT THE YEAR. IT IS USUALLY AT ITS LOWEST IN THE SUMMER AND AT ITS HIGHEST IN THE WINTER. *

11. THE ST. LUCIE RIVER GENERALLY HAS A SALINITY LOWER THAN THE INDIAN RIVER. *

12. THIS IS THE RESULT OF FRESH WATER INTRUSION: THE RUN-OFF FROM THE LAND AND THE ST. LUCIE CANAL. *

13. WHAT CAUSES THE SALINITY CHANGES? *

14. TIDES AND FRESH WATER INTRUSION. *

15. THE SALINITY IS MEASURED BY THE REFRACTOMETER. *

16. THE SECOND PHYSICAL FACTOR WE WILL DISCUSS IS TURBIDITY. TURBIDITY IS THE CLOUDINESS OF THE WATER. *

17. LOOK AT THE DIFFERENCE BETWEEN THE TWO BEAKERS OF WATER. THE ONE ON THE RIGHT IS TURBID. *

18. THE MUD ON THE BOTTOM USUALLY CAUSES THE RIVER TO BE CLOUDY OR TURBID. *

19. MUCH OF THIS MUD IS THE RESULT OF THE MANGRAOVE DEVELOPMENT ALONG SALT WATER SHORELINES.. STRONG WINDS, CURRENTS AND TIDES CONTINUALLY WORK THE WATER AROUND THE ROOTS OF THESE MANGROVES STIRRING UP THE MUD. *

20. WHAT CAUSES THE RIVER TURBIDITY? *

21. WIND, TIDES AND THE RIVER'S CURRENT CONSTANTLY STIR UP THE DEBRIS AT THE MANGROVE ROOTS. *

22. TURBIDITY IS MEASURED BY THE SECCHI DISC. IT IS LOWERED OVER THE SIDE OF THE BOAT TO THE BOTTOM. IT IS SLOWLY BROUGHT UP UNTIL IT IS JUST VISIBLE. AT THE SAME TIME THE WATER COLOR CAN BE READ ON THE INTERNATIONAL SCALE SHOWN ON THE RIGHT. *

23. THE THIRD PHYSICAL FACTOR WE WILL DISCUSS IS TEMPERATURE. TEMPERATURE IS THE MEASUREMENT OF THE AMOUNT OF HEAT IN AN AREA SUCH AS AIR, SOIL, OR WATER. THE TEMPERATURE OF THE RIVER IS IMPORTANT TO THE KIND OF ORGANISMS THAT DEVELOP THERE. THE TEMPERATURES OF THESE WATERS ARE CONSIDERED TROPIC. *

24. TROPIC TEMPERATURES OF THE WATER IN OUR AREA USUALLY RANGE FROM A HIGH OF MID -80'S IN THE SUMMER TO A LOW OF MID-60'S IN THE WINTER. THOUGH THESE TEMPERATURES ARE USUAL, THEY CAN RANGE HIGHER OR LOWER DEPENDENT UPON THE SEASONAL WEATHER. *

25. WHAT INFLUENCES RIVER TEMPERATURE? *

26. TIDES, STORMS, TIME OF DAY, TIME OF THE YEAR AND THE DEPTH OF THE WATER. *

27. AS YOU KNOW THE THERMOMETER MEASURES THE TEMPERATURE. NOTICE THIS THERMOMETER. WE ARE USED TO THE FAHRENHEIDT SCALE, 32^{o} IS FREEZING AND 212^{o} IS BOILING. THE OTHER SCALE IS CENTIGRADE. $0^{o}C$ IS FREEZING AND 100^{o} IS BOILING. *

28. WHAT CAUSES THE DEEP AREAS IN THE RIVER? REMEMBER DEPTH IS A PHYSICAL FACTOR. *

29. CURRENTS, TIDES AND DREDGING. *

30. THE INDIAN AND THE ST. LUCIE RIVERS ARE BOTH SHALLOW RIVERS. BECAUSE OF THIS FACTOR GRASSFLATS ARE ABLE TO DEVELOP. A GRASSFLAT NEEDS SHALLOW WATER FOR THE SUNLIGHT TO REACH THE GRASS. *

31. THE ONLY AREAS THAT CAN BE CALLED DEEP ARE THOSE THAT HAVE BEEN DREDGED FOR THE CHANNEL OR THOSE THAT ARE ALONG THE BANKS THAT HAVE BEEN WORN AWAY BY THE TIDES AND CURRENT. *

32. THE DEPTH OF THE WATER IS MEASURED BY USING A DEPTH LINE. THIS LINE IS DIVIDED INTO METERS. THE END OF THE LINE IS WEIGHTED. *

33. WHAT ARE THE DIFFERENT TYPES OF RIVER BOTTOM ? *

34. THE BOTTOM TYPES DO VARY. WHAT TYPES OF RIVER BOTTOM DO YOU SEE HERE? *

35. SAND, MUD, BROKEN SHELLS OR A MIXTURE OF THESE ARE EXAMPLES OF RIVER BOTTOM. *

36. A BOTTOM GRAB IS USED TO SAMPLE THE RIVER BOTTOM. THIS SAMPLE IS PLACED ON

A SIEVE FOR CLOSE EXAMINATION. *

37. NOW LET'S REVIEW. TAKE PENCIL AND PAPER AND ANSWER THE FOLLOWING QUESTIONS ABOUT RELATIONSHIPS AMONG THE PHYSICAL FACTORS OF THE RIVER. *

TEACHER - This is the end of the tape. Turn the tape player off and advance next five slides as your students finish writing their answers. Go over their answers either one slide at a time or all at the conclusion of the exercise.

38. "What can cause SALINITY changes?" (Answer: a) Regular tidal changes; b) fresh water intrusion from heavy rains; c) land run-off and discharges from the St. Lucie Canal.) *

39. "What can cause the river turbidity?" (Answer: wind, tide and currents.) *

40. "What causes the deeper areas in the river?" (Answer, dredging, tides and fast-moving currents.)*

41. "What types of river bottom are there?" (Answer: sand, mud, shell) A follow-up question might ask "What causes the different types?" (Answer, sandy - strong currents; muddy - Mangrove development; grassy - calm, shallow water and tropic temperature.) *

42. "What can influence changes in river temperature?" (Answer: water depth, time of day, time of year, storms and tides.) *

If there are other questions, you will find the answers in the other materials we have provided for the river investigation.

The End.

TEACHER - Please rewind the tape for next use. Thanks.

PROBLEMS

Sixth Grade

INTRODUCTION TO ENVIRONMENTAL PROBLEMS

Why do clams live in the St. Lucie River?

Why are MANGROVES found along the river shores?

Why are manatee GRASSFLATS found in one area and turtle GRASSFLATS found in another?

Part of your environmental unit is to study and measure the physical factors of the river. For instance you will measure temperature, salinity, wind speed and turbidity. At the same time you will be discovering certain ORGANISMS (plants and animals) that live in these conditions. Why are these ORGANISMS there?

Simply, these ORGANISMS live there because the TEMPERATURE, SALINITY, TIDAL changes, etc. are just right for their needs.

Can you see an overall relationship between organisms and the PHYSICAL FACTORS which make up part of their total environment?

Clams live in the St. Lucie River because they live best in the TEMPERATURE, mud, TIDES, and SALINITY of that water. These same RELATED PHYSICAL FACTORS cause MANGROVES to exist along the shoreline. Certain types of grass exist because the sand, CURRENT, TEMPERATURE, and SALINITY are in a RELATIONSHIP that provides ideal conditions.

Now what if we alter or change certain factors or conditions in this environment? For example: increase the water TEMPERATURE or lower the SALINITY. These changes alter the environment of many ORGANISMS.

Changes in environmental conditions may or may not be a PROBLEM. Some ORGANISMS adjust. Others??

This PROBLEMS booklet presents some environmental questions. Certain PHYSICAL FACTORS in the St. Lucie and Indian Rivers have been altered by us -- man -- for various reasons. The reasons and results should be a concern to all citizens of our counties.

MANGROVES

WHAT IS A MANGROVE?

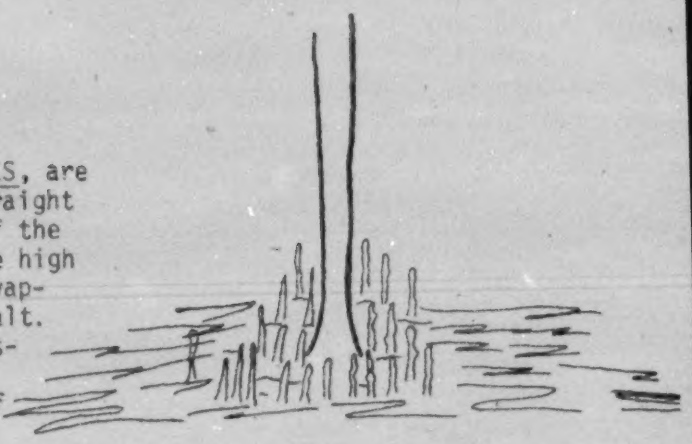
A MANGROVE is a type of tree that generally grows in or near salt water. We have three types of mangroves in the southeast Florida area - white, black and red. The value of these mangroves is viewed differently by developers, fishermen, tourists, conservationists, farmers, and people like yourselves.

WHITE MANGROVES

The white mangrove is usually found back from the shoreline. It is recognized by its notched leaf tips and a pair of tiny swellings at the leaf base. There are no prop roots and few breathing roots, but its underground root system secures the banks from soil erosion.

RED MANGROVES

At the water's edge is the Red Mangrove. This tree is a great landbuilder. Around the long-reaching aerial prop roots all sorts of "goodies" are trapped: eroded soil from the shore, fallen leaves, decaying plants and animals. This is all called DETRITUS. Detritus is the source of vitamins, minerals and other nutrients to the food webs of the water's inhabitants.



BLACK MANGROVES

The breathing roots, called PNEUMATOPHORES, are part of the Black Mangrove. They are straight finger-like structures around the base of the tree. The Black Mangrove is found in the high tide zone or in places where the water evaporates, leaving high concentrations of salt. The leaves of the Black Mangrove also distinguish it from the White and Red. The backs are silvery and the leaves taste of salt. The breathing tube-like fingers around the trunk also act as "catch-alls" to the DETRITUS in the water. Many animals live in and on the mangrove trees. Look at the film loop Mangrove Swamp and the reference books listed on page 4.

WHAT DO YOU KNOW ABOUT MANGROVES?

1. What is a mangrove?
2. Where do you find the mangroves growing?
3. What are the three common types of mangrove found?
4. List six organisms that live in and around the mangroves.
5. Why do these organisms live there?
6. What would be the effect of fresh water flooding in mangroves?
7. Florida has a law that protects the Red Mangrove from being destroyed. Why?

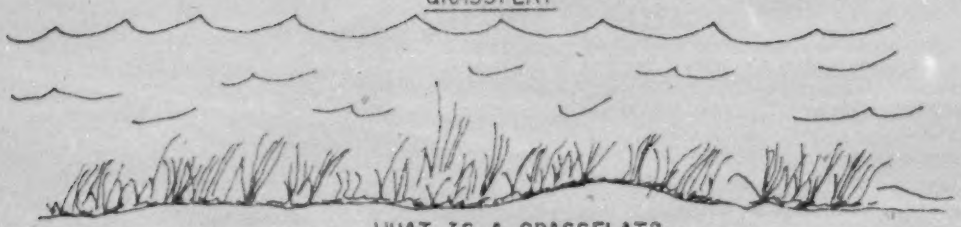
MANGROVE VOCABULARY

MANGROVES	- any of the various tropical evergreen trees or shrubs found along the tidal shores forming dense thickets
PNEUMATOPHORE	- a special "breathing" root found on certain water plants
DETRITUS	- any disintegrating matter or debris
AERIAL	- born in the air rather than underground or underwater
EROSION	- the wearing away of something, i.e., soil by water or wind

MORE ABOUT MANGROVES

1. Film loop, 8mm: Mangrove Swamp - Food Web
2. Books: (a) Life of the Seashore by Wm. Amos, pp. 130-132, 178-179
   (b) Life and Death of the Salt Marsh by J & M Teal, pp. 156-158, 216, 216-217, 253-254

GRASSFLAT



WHAT IS A GRASSFLAT?

A grassflat, for our study, is an area of grass found in the shallow water of the Indian or St. Lucie rivers. For a grassflat to exist certain physical factors must exist.

First, soil is necessary for the grass to anchor its roots.

Second, the grassflats found in the Indian River need water to cover the grass. It must be shallow enough to allow the sunlight to reach the grass cells, thereby providing the necessary energy for PHOTOSYNTHESIS, but deep enough to continually cover the grass.

These two factors - water shallow enough to allow sunlight to reach the grass, yet deep enough to cover the grass are PHYSICAL FACTORS. These factors limit the kind of grass that makes up the grassflats.

The kind of grass is also determined by other physical factors - current, range of water temperature, pressure, range of SALINITY, amount of oxygen, carbon dioxide and minerals.

Living within these GRASSFLAT HABITATS are various animals and plants. The grassflats serve as a nursery for many GAME FISH, MOLLUSKS AND CRUSTACEANS. Any drastic alteration in the physical conditions of the HABITAT could result in loss of these animals.

WHAT DO YOU KNOW ABOUT A GRASSFLAT?

1. What is a GRASSFLAT?
2. List physical factors necessary for a grassflat to exist.
3. Why is a GRASSFLAT referred to as a nursery?
4. List ten animals and plants in a GRASSFLAT environment (fresh or marine).
5. List three ways a GRASSFLAT is important.
6. Why is dredge and fill (of the Indian River Lagoon) an environmental problem?
7. List three ways the people in Martin County can preserve grassflats in our rivers and lakes.

GRASSFLAT VOCABULARY

CRUSTACEA - a class of arthropods which breathe by means of gills, and the body is covered by a hard shell or crust; also have two pairs of antenna; includes barnacles, shrimp and crabs

"DREDGE & FILL" - man digging up & depositing soil from an area to alter his environment

GRASSFLAT - an area of grass found in shallow waters, deep enough to continuously cover the grass

HABITAT - the place where an organism lives

PHYSICAL FACTOR - any non-living factor that regulates growth in an ecosystem

MOLLUSCA - a phylum of invertebrates with soft, unsegmented bodies covered by a fleshy mantle which usually secretes a shell; e.g. chiton, snail, oyster, squid

PHOTOSYNTHESIS - the process by which plants with chlorophyll use light energy to manufacture carbohydrates and release oxygen

SALINITY - a measure of the quantity of dissolved salts in sea water, usually expressed in parts per thousand

MORE ABOUT GRASSFLATS

1. 8mm film loops -

   shows mainly some inhabitants of grassflats:

   (a) seahorse
   (b) manta and sting rays
   (c) pelican

2. 8 x 10 aerial photograph of:

   (a) river showing grassflat
   (b) seining

POLLUTED RIVER

WHAT IS A POLLUTED RIVER?

A RIVER IS POLLUTED when it has been CONTAMINATED or made in some way impure. This contamination can be by anything that alters the normal conditions of the river. For example:

1. waste from industry
2. sewage and garbage
3. change in salinity
4. unnatural increase or decrease in temperature

The osprey and the bald eagle once were a very familiar sight along the Indian and St. Lucie Rivers. The fish they ate for food carried the RESIDUE of a pesticide, DDT. This pesticide was used by farmers and citrus growers. Rain washed it into the irrigation ditches. These flowed into the St. Lucie River. This DDT residue in the fish caused the eggs laid by the osprey and eagle to have soft shells. These soft shells break easily and are infected. This is one of the main reasons there has been such a sharp decrease in the osprey and the bald eagle populations.

Oyster and clam farming in the rivers just a few years ago was common in the Martin County area. As the population of people increased, the practice of dumping the raw sewage into the river also increased. The rivers were no longer able to take care of this sewage naturally. A VIRUS from the sewage may be picked up by the clams and oysters due to their eating habits. This virus does not harm the oysters and clams but it does cause a very severe liver condition in humans called HEPATITUS.

Other forms of river pollution resulting from salinity changes and temperature changes are discussed in the following parts of this booklet.

1. salinity change .... ST. LUCIE LOCK
2. temperature change .... NUCLEAR POWER PLANT

WHAT DO YOU KNOW ABOUT POLLUTED RIVERS?

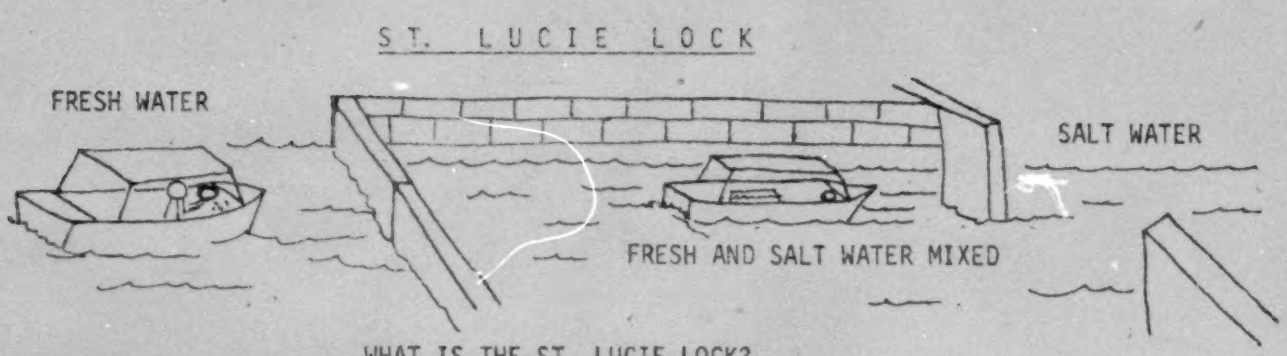
1. What is a POLLUTED RIVER?
2. List three causes of pollution in the Indian or St. Lucie Rivers.
3. Why CAN'T we eat the oysters and clams from the Indian River in our area?
4. What is one reason there is a decrease in the populations of the osprey and the bald eagle?
5. What are some suggestions that you have for cleaning up the rivers?

POLLUTED RIVER VOCABULARY

CONTAMINATION	- to make something impure
POLLUTION	- the contamination of the soil, water or air by various means that are harmful
RESIDUE	- that which is left after something else has been removed
PESTICIDE	- a chemical that is used to kill pests, especially insects
IRRIGATION	- water supplied to dry lands by means of ditches, etc.
POPULATION	- the total number of any one kind of living thing in an area
HEPATITUS	- a liver condition noted by yellowing of skin and can be caused by a virus

MORE ABOUT POLLUTED RIVERS

1. Film loops 8mm: (a) Mollusks
   (b) Seashore - plant and animal adaptations (note in particular, siphons operation in the razor clam)
2. Books: (a) Life of the Seashore by Wm. Amos, pp. 138-145
   (b) Life of the Marsh by Wm. Niering, pp. 170-176
   (c) Let's Go - To Stop Water Pollution by M. Chester
   * (d) Lower Animals, Living Invertebrates of the World by Buchsbaum
   * (e) Water by Time Life Science Library, pp. 175-177
   * (Should be available in your Media Center.)
3. 16 mm film #74 available from the Instructional Center: Lakes: Aging and Pollution - most parts of this excellent film on lakes can be related to our rivers.



WHAT IS THE ST. LUCIE LOCK?

The St. Lucie LOCK is one of a series of locks built by the Army Corps of Engineers across canals leading away from Lake Okeechobee. The system of canals was built to prevent flooding. During a hurricane in 1928, the water in the lake was pushed over the sides by the wind like water spilling from a saucer causing disastrous flooding and loss of life. The canals help drain excess water and prevent future flooding around Lake Okeechobee.

The St. Lucie LOCK was built around 1930 across the St. Lucie Canal. It is a folding gate that is opened and shut allowing boats to pass through. When the LOCK is opened one and a half million gallons of fresh water is sent along the canal into the salt waters of the St. Lucie River.

Animal and plant life in the St. Lucie River depend on a certain amount of salt being in the water. This life has somewhat adapted to the regular INTRUSION of the fresh water from Lake Okeechobee. But, at certain times of the year when the water level in Lake Okeechobee is extremely high, the flood gates adjoining the boat LOCK are opened for long periods of time.

When these gates are opened, large amounts of fresh water flow down the St. Lucie River.

What do you think happens to the amount of salt in the St. Lucie River?

What if the gates are kept open long enough to reduce the salinity to zero?

Can the animal and plant life dependent on the salt, survive?

Farmers and citrus growers depend on the water flowing through the canals. Crops and groves are irrigated by the water. The amount of water available to these farmers and citrus growers is dependent upon the amount of water in the lake. The flood gates at the St. Lucie Lock control the flow of water from the lake. All the fresh water not used to irrigate is lost in the sea.

Are there perhaps other ways to use this water?

WHAT DO YOU KNOW ABOUT THE ST. LUCIE LOCK

1. What is a LOCK?
2. Why were the canals built?
3. Why is the network of canals important to farmers and citrus growers?
4. How do the locks and flood gate systems affect the water level of Lake Okeechobee?
5. Where does the water controlled by the St. Lucie Lock go?
6. What environmental problem can this water create?
7. Do you have any suggestions for better use of this fresh water?

ST. LUCIE LOCK VOCABULARY

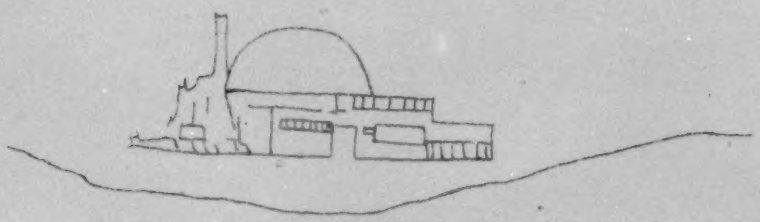
LOCK - a section of a canal that is closed off with gates; this section of water can be raised or lowered to allow the passage of boats

INTRUSION - an unwelcomed addition

MORE ABOUT THE ST. LUCIE LOCK

1. Check the Florida section of your school library.
2. Laminated copy of the Miami Herald newspaper clipping, "Irrigation Outlook 'Best in Four Years'" - 10/4/73

NUCLEAR POWER PLANTS



WHAT IS A NUCLEAR POWER PLANT?

A NUCLEAR POWER plant is an electrical generating plant that uses nuclear energy to produce electrical power.

Construction of a NUCLEAR POWER plant facility along the eastern shore of the Indian River in the south section of St. Lucie County began in 1969. This completed nuclear facility will contain two REACTORS, therefore be equal to two (2) NUCLEAR POWER plants.

This nuclear plant is operated by the Florida Power and Light Company. The controls and standards for construction and operation are set by the Atomic Energy Commission.

The increase in population in south Florida increases the demand for electrical power. A nuclear plant can produce approximately twice as many MEGA WATT hours as a FOSSIL FUEL plant.

One of the causes of an energy crisis is the decrease in the available supply of FOSSIL FUELS, i.e. oil, natural gas. This decrease in supply increases the price of the available supply. It is presumed a nuclear plant over a period of years can produce electrical power at a much lower cost than a FOSSIL FUEL plant.

Due to the increase in population the NUCLEAR POWER plant does provide the electrical power considered needed in the south FLORIDA area.

Can you think of any environmental problem created by more people?

What environmental problems can be created by a nuclear power plant?

Water to cool the CONDENSERS is drawn in from the ocean. This water used for cooling is returned to the ocean up to 10^{o} warmer than the ocean temperature. Animal and plant life in the area of the intake and output pipe is adapted to water temperatures of the ocean. Some life CANNOT live in the waters $10^{o}F$ warmer.

Can this be a problem to the environment?

WHAT DO YOU KNOW ABOUT NUCLEAR POWER PLANTS?

1. What is a nuclear power plant?
2. Why is the plant being built?
3. Who is building it?
4. Why is nuclear fuel being used rather than fossil fuel to make electrical energy?
5. What effect can the water returning to the ocean from the power plant have on animals and plants in the ocean?
6. Why do you think NUCLEAR POWER PLANTS could be an environmental problem?
7. List three solutions to our current energy crisis.

NUCLEAR POWER PLANT VOCABULARY

CONDENSER	- apparatus used to change water vapors (a gas) to a liquid by a cooling process
FOSSIL FUEL	- fuel like coal, gas, oil, etc. that comes from ancient plants and animals
MEGA WATT	- a million units of power in a unit called a watt
NUCLEAR POWER	- energy released by nuclear reaction
REACTOR	- a device in which a chain reaction is started and controlled to produce heat

MORE ABOUT NUCLEAR POWER PLANTS

BOOKS:

a. The Story of Nuclear Power by E. H. Childs
b. Electricity & Man by Isaac Asimov, pp 26-43
c. Sources of Nuclear Fuel by A. Singleton, Jr., pp 26-31
d. Nature's Invisible Rays by Jacob Kastner, pp 13-15; 22; 32-36; 41-42
e. Nuclear Power Plants by Lyerly & Mitchell, pp 24-27 (pictures good)
f. Atomic Energy and Your World by Glasston & Thomas, pp 5-9; 25-26; 45; 51
g. Breeder Reactors by Mitchell & Turner, pp 2-3; 42-43
H. Nuclear Terms - a glossary

FILM - 16 mm:

a. #105 available from the Martin County Instructional Center; Controlling Atomic Energy. This film provides a background on NUCLEAR ENERGY

OTHER: 8 x 10 aerial picture of plant being built
Slides - tapes

6th Grade Slide Presentation

"Problems"

TEACHER - Turn on projector to "Focus" slide. Turn on tape player and change slide at audible tone. (If you are reading the narration instead, change slides as indicated by the asterisk (*). Narrative is in CAPITAL letters.

1. Focus *

2. "Credits" slide *

3. "An Environmental Study Unit on River Investigations" *

4. "Problems" WHEN YOU ARE ON BOARD THE RIVER SCOUT YOU WILL BE MEASURING SOME OF THE RIVER'S PHYSICAL FACTORS. AT THE SAME TIME YOU WILL SAMPLE THE PLANTS AND ANIMALS THAT LIVE WITHIN THESE FACTORS. *

5. WHY ARE THERE MANGROVES ALONG THE SHORES OF THE INDIAN AND ST. LUCIE RIVERS? CONDITIONS ALONG THE SHORES ARE IDEAL FOR MANGROVE GROWTH AND DEVELOPMENT. WHAT HAPPENS IF THESE CONDITIONS ARE ALTERED? WHAT COULD KILL THE MANGROVES? *

6. WHAT CAN CAUSE GRASSFLATS TO DISAPPEAR? *

7. WHAT HAPPENS IF FRESH WATER FLOWS TOO LONG INTO THE NORMAL SALT WATER OF THE INDIAN RIVER? *

8. WHAT HAPPENS TO THE BALANCE BETWEEN THE PHYSICAL FACTORS OF THE RIVER AND THE ORGANISMS THAT DEVELOP WITHIN THEM IF THERE IS A SHARP INCREASE IN HUMAN POPULATION? THESE ARE SOME OF THE ENVIRONMENTAL PROBLEMS THAT CONCERN YOU. *

9. WHAT IS A MANGROVE? A MANGROVE IS A TYPE OF TREE THAT GROWS IN OR NEAR SALT WATER. THERE ARE THREE KINDS OF MANGROVES COMMONLY FOUND IN SOUTH FLORIDA. *

10. YOU CAN LEARN TO TELL THE MANGROVES APART BY EXAMINING THE LEAVES. THE RED MANGROVE HAS LONG, POINTED, WAXY, THICK, REDDISH-GREEN LEAVES. THE BLACK HAS POINTED LEAVES, SMALLER THAN THE RED, AND THEY ARE THIN, DARK GREEN WITH A SILVER BACK. THE WHITE HAS ROUNDED,WAXY,THICK, GREENISH-YELLOW LEAVES THAT OFTEN ARE NOTCHED AT THE TIP AND HAVE THE TWO GLANDS AT THE BASE. *

11. WHITE MANGROVES ARE FOUND BACK FROM THE SHORE. THERE ARE TWO GLANDS OR PORES AT THE BASE OF THE LEAF AS SEEN IN PICTURE "B". SALT LEAVES THE TREE THROUGH THESE PORES. *

12. THE RED MANGROVE IS THE MOST TYPICAL. DEBRIS IS CAUGHT IN THE TANGLE OF PROP ROOTS SEEN REACHING INTO THE WATER FROM THE SHORE. THE RED MANGROVE SEEDLING AS SEEN IN "B" HANGS LIKE A LONG BEAN. WHEN IT DROPS, IT FLOATS ALONG UNTIL THE BASE IS CAUGHT IN THE SOIL. *

13. THE BLACK MANGROVE IS FOUND IN AREAS OF HIGHEST SALINITY. THE BARK IS DARK. THE LEAVES ARE SMALLER THAN THOSE OF THE RED AND GIVE A SILVER CAST TO THE TREE. *

14. THE ROOTS OR BREATHING TUBES OF THE BLACK MANGROVE ARE FOUND AT THE BASE OF THE TRUNK. THESE LOOK LIKE FINGERS. THESE ROOTS COLLECT DETRITUS LIKE THE PROP ROOTS OF THE RED MANGROVE. *

15. MANY ORGANISMS LIVE AROUND THE ROOTS OF THE RED AND BLACK MANGROVES. FOUR ARE SEEN HERE: CLAMS....SPIDERS....OYSTERS....AND CRABS.... SOME OTHER MANGROVE INHABITANTS ARE SNAILS, MUSSELS, BARNACLES, SHRIMP AND ALGAE. *

16. THE ROSEATE SPOONBILL IS ONE OF MANY BIRDS THAT SPEND A LOT OF TIME AROUND THE MANGROVES. *

17. WHAT IS A GRASSFLAT? *

18. A GRASSFLAT IS AN AREA OR FLAT OF GRASS IN THE RIVER. MANY FLATS OF GRASS ARE FOUND IN THE INDIAN RIVER. CAN YOU THINK OF THE PHYSICAL FACTORS IN WHICH THESE GRASSES DEVELOP? THE WATER GRASSES IN OUR AREA NEED WARM, SHALLOW SALT WATER. WHY DOES THE WATER NEED TO BE SHALLOW FOR ANY WATER GRASS TO SURVIVE? *

19. GRASSFLATS PROVIDE IDEAL HABITATS FOR THE SMALLER ORGANISMS OF THE RIVER. SOME OF THE FISH FOUND IN GRASSFLATS ARE: PINFISH, PUFFER, SNAPPER AND SHEEPSHEAD. REMEMBER THAT THE GRASSFLATS ARE HABITATS OF THE YOUNG GAME FISH AS WELL AS OF SHRIMP, CRABS AND SPINY LOBSTERS THAT YOU CATCH AND EAT. *

20. THE STINGRAY ALSO LIVES IN AND AROUND THE GRASSFLATS. THAT IS WHY WE ADVISE YOU, WHEN WADING OR SEINING, TO SHUFFLE YOUR FEET TO AVOID STEPPING ON THE RAY. SHOULD YOU STEP ON HIM, HE WILL THRASH AROUND IN AN EFFORT TO ESCAPE AND MIGHT INFLICT A PAINFUL WOUND WITH A BARB LOCATED MIDWAY ON HIS TAIL. *

21. THE MULLET FINDS FOOD AND PROTECTION AROUND THE GRASSFLATS AND IS A VERY IMPORTANT LINK IN THE RIVER'S FOOD CHAIN. *

22. THIS 24 POUND SNOOK IS ANOTHER OF THE MANY EDIBLE MARINE ANIMALS THAT, WHEN SMALL, GROW UP IN THE PROTECTION OF THE GRASSFLAT COMMUNITY. INCIDENTALLY, ONE OF ITS FAVORITE FOODS IS THE MULLET. *

23. WHEN PHYSICAL FACTORS ARE DISTURBED, BY DREDGING FOR EXAMPLE, WHAT CAN HAPPEN? DOES EVERYTHING DIE? WHY NOT? *

24. WHAT IS A POLLUTED RIVER? A RIVER IS POLLUTED WHEN IT HAS BEEN CONTAMINATED OR MADE IN SOME WAY IMPURE. CONTAMINATION CAN BE CAUSED BY ANYTHING THAT CHANGES THE NORMAL CONDITIONS OF THE RIVER. FOR EXAMPLE, INDUSTRIAL WASTES, SEWAGE AND GARBAGE, SALINITY CHANGE AND TEMPERATURE CHANGE CAN BE CONSIDERED A TYPE OF CONTAMINATION. *

25. THIS OVERVIEW OF THE SOUTH EAST FLORIDA FLOOD CONTROL DRAINAGE SYSTEM MAY GIVE YOU AN IDEA OF HOW EASILY POLLUTANT FACTORS FROM LAND DRAINAGE COULD REACH LAKE OKEECHOBEE AND THE ST. LUCIE AND INDIAN RIVERS. *

26. MANY OSPREY, EAGLE AND HAWK NESTS THAT WERE ONCE OCCUPIED ARE NOW EMPTY. IT IS BELIEVED THAT ONE OF THE REASONS FOR THIS DISSAPEARANCE IS THE WIDE-SPREAD USAGE OF THE PESTICIDE DDT. *

27. THIS PESTICIDE WAS ONCE USED ON CROPS. IT WASHED INTO THE IRRIGATION DITCHES AND WAS TAKEN IN BY THE FISH FOUND THERE. THE HAWK, OSPREY AND EAGLE ATE THE FISH AND THE DDT BUILT UP AS A RESIDUE IN THEIR SYSTEMS. THIS BUILD UP OF DDT CAUSED THEIR EGGS TO HAVE THIN SHELLS THAT WERE EASILY BROKEN. *

28. OYSTER FARMING WAS ONCE COMMON IN MARTIN COUNTY. RAW SEWAGE DUMPED INTO THE RIVER INCREASED AS THE POPULATION INCREASED. A VIRUS FROM THE SEWAGE MAY BE PICKED UP BY MUSSELS AND OYSTERS. THOUGH THIS VIRUS DOES NOT AFFECT THE OYSTER AND MUSSEL, IT CAN CAUSE A LIVER DISEASE CALLED HEPATITUS IN PEOPLE WHO EAT THE OYSTERS. *

29. WHAT IS THE ST. LUCIE LOCK? *
THE ST. LUCIE LOCK IS ONE OF A SERIES OF STRUCTURES BUILT BY THE ARMY CORPS OF ENGINEERS ACROSS CANALS THAT DRAIN WATER FROM LAKE OKEECHOBEE. *

30. THE STRUCTURE INCLUDES A SERIES OF SPILLWAYS TO REGULATE THE CANAL'S WATER LEVEL AND A LOCK OR FOLDING GATE THAT IS OPENED AND SHUT TO LET BOATS PASS THROUGH. EACH TIME THE LOCK IS OPENED AS SEEN IN PICTURE "B", 1½ MILLION GALLONS OF WATER ARE LET INSIDE. THE BOATS ENTER AS SEEN IN PICTURE "C" AND TIE UP AS SEEN IN PICTURE "D". *

31. THE GATE THROUGH WHICH THE BOAT ENTERED IS CLOSED. THE OPPOSITE GATE IS OPENED SO THE WATER DRAINS SLOWLY INTO THE CANAL THAT LEADS INTO THE ST. LUCIE RIVER AS SEEN IN PICTURES "B" AND "C". WHEN THE WATER LEVEL INSIDE THE LOCK IS LEVEL WITH THIS CANAL, THE GATE IS OPENED COMPLETELY AND THE BOAT IS ON ITS WAY AS SEEN IN PICTURE "D". *

32. THE FISH AND OTHER ANIMALS AND PLANTS IN THE AREA OF THE LOCK ARE USED TO THE REGULAR SALINITY CHANGE FROM THE FRESH WATER INTRUSION AND HAVE LEARNED

TO ADAPT. IT IS WHEN THE SPILLWAY GATES REMAIN OPEN TO DRAIN LARGE AMOUNT OF WATER FROM LAKE OKEECHOBEE THAT A PROBLEM IS CREATED. *

33. FARMERS AND CITRUS GROWERS DEPEND ON THE WATER FLOWING THROUGH THE CANALS FOR IRRIGATION. THE RUN-OFF FROM THESE CROPS THEN DRAINS INTO THE CANALS AND DITCHES. *

34. AMONG THE RESULTS OF THIS RUN-OFF AND SALINITY CHANGE FROM THE OPENED GATES ARE FROTHY WATERS, DEAD FISH AND ALGAE BLOOMS. *

35. WHAT ABOUT ALL THIS FRESH WATER THAT IS LOST TO THE SEA? COULD THERE BE ANOTHER WAY TO USE THIS WATER? *

36. WHAT IS A NUCLEAR POWER PLANT? A NUCLEAR POWER PLANT USES NUCLEAR ENERGY RATHER THAN FOSSIL FUELS TO PRODUCE ELECTRICAL POWER. REMEMBER IT WAS THE SHORTAGE OF FOSSIL FUELS, OIL AND GAS, THAT PRODUCED THE ENERGY CRISIS OF 1974. *

37. THE GREATER THE INCREASE IN POPULATION, THE GREATER THE DEMAND FOR ELECTRICAL POWER. A NUCLEAR PLANT IS ABLE TO PRODUCE MORE POWER AT A SINGLE SITE THAN A FOSSIL FUEL PLANT CAN AND OVER A PERIOD OF TIME AT A LOWER COST. *

38. CONSTRUCTION OF A TWIN NUCLEAR POWER PLANT FACILITY IS UNDERWAY IN SOUTH ST. LUCIE COUNTY ON HUTCHINSON ISLAND. *

39. HOUSED IN THE DOMED STRUCTURE IS THE NUCLEAR REACTOR VESSEL, IN WHICH URANIUM IS ALLOWED TO UNDERGO A SERIES OF NUCLEAR REACTIONS RELEASING HEAT. THE HEAT IS USED TO TURN LIQUID WATER INTO STEAM WHICH IS USED TO DRIVE A GENERATOR. THE GENERATOR THEN CONVERTS MECHANICAL ENERGY INTO ELECTRICAL ENERGY IN USEABLE FORM. *

40. THE ELECTRICAL ENERGY IS TRANSMITTED THROUGH LINES TO AREAS THAT FLORIDA POWER AND LIGHT SUPPLIES WITH ELECTRICITY. *

41. THE COOLING PROCESS FOR CHANGING THE STEAM BACK INTO LIQUID WATER REQUIRES ANOTHER SOURCE OF WATER TO TAKE UP THE HEAT. THE WATER FOR COOLING IS PIPED IN FROM THE OCEAN THROUGH AN INTAKE CANAL. THIS COOLANT WATER IS RETURNED TO THE OCEAN BY AN OUT-TAKE CANAL, BUT THE TEMPERATURE OF THE WATER IS NOW ABOUT 10 DEGREES WARMER THAN BEFORE. *

42. THIS 10 DEGREE INCREASE IN THE WATER TEMPERATURE CAN CAUSE PROBLEMS FOR THOSE ORGANISMS THAT ARE NOT ABLE TO ADJUST TO THE CHANGE. SEA TURTLES USE THE BEACH IN FRONT OF THE NUCLEAR PLANT AS A SITE TO LAY THEIR EGGS. CAN YOU THINK OF OTHER ENVIRONMENTAL PROBLEMS THAT COULD BE CREATED BY A NUCLEAR POWER PLANT? *

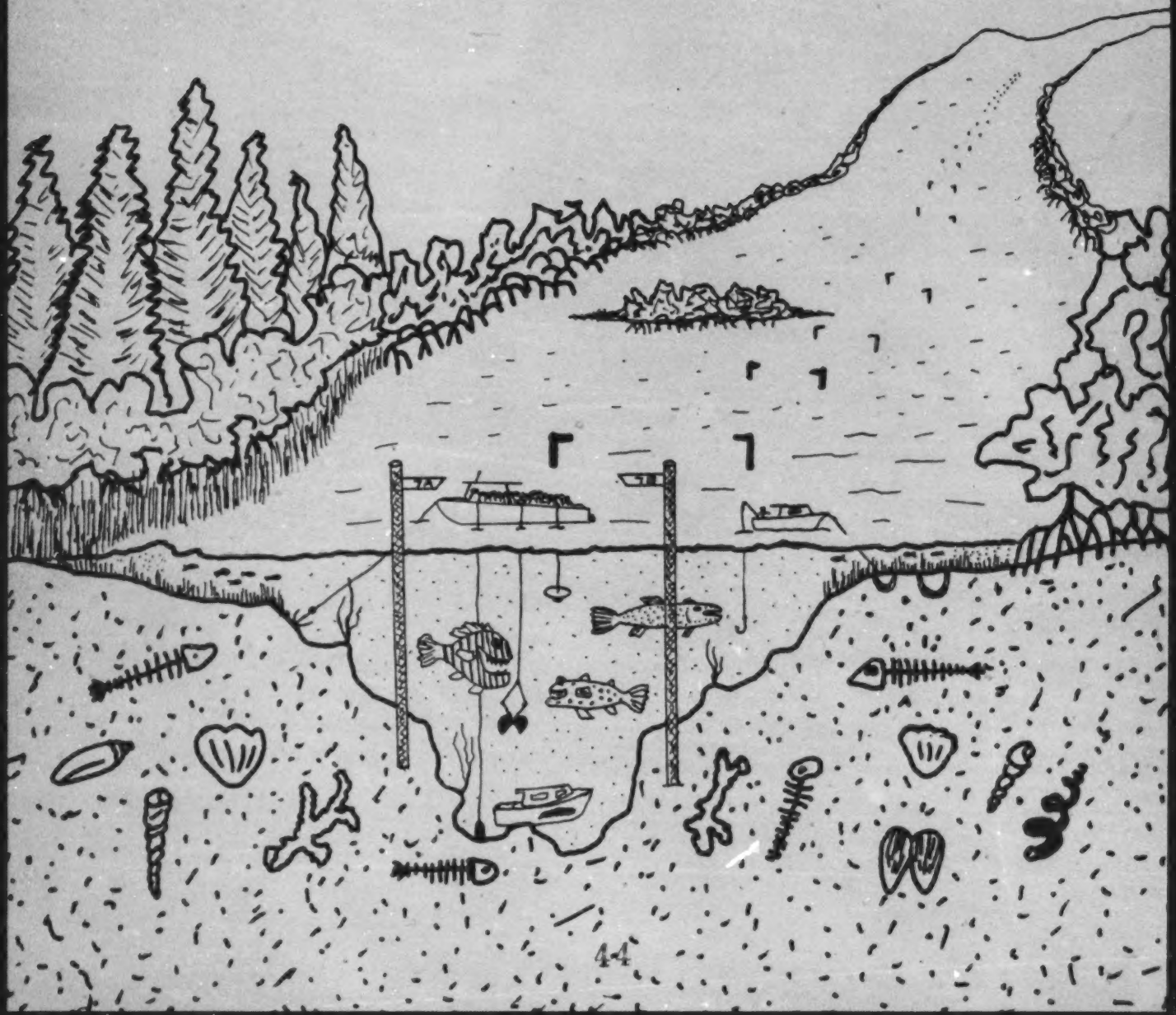
43. ARE THERE SOLUTIONS TO THE ENERGY CRISIS OTHER THAN SIMPLY THE PRODUCTION OF MORE POWER? *

44. MAN STRIVES FOR PROGRESS BUT OFTEN AT THE SACRIFICE OF THE WORLD AROUND HIM. CAN HE LEARN TO ACHIEVE HIS PROGRESS GOALS AND LIVE IN HARMONY WITH THE NON-HUMAN LIFE AROUND HIM, SO THAT THEY TOO CAN SURVIVE?

TEACHER - Please rewind tape for next use. Thanks.

Sixth Grade

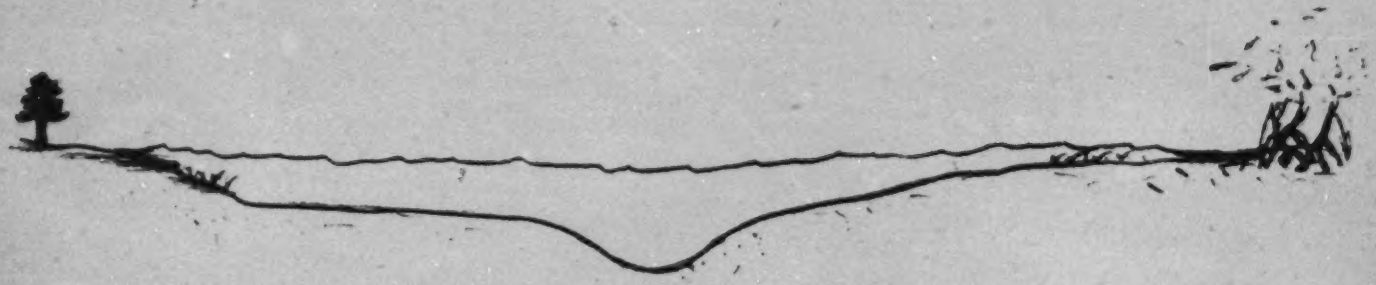
AN INDIAN RIVER PROFILE



AN INDIAN RIVER PROFILE

What is a profile?

A profile is a side view of something. So a river profile is what the river looks like from the side.



To make a profile of the Indian River you have to investigate the river. The profile you will be making will show PHYSICAL CONDITIONS of the river.

Let's say at each of 4 locations an investigation was made for the PHYSICAL CONDITIONS of:

1. depth of water
2. amount of salt in the water (SALINITY)
3. water temperature, and
4. type of river bottom

For each PHYSICAL CONDITION, 3 readings were taken. Each of the readings was written down on the DATA sheet for that activity.

The 3 readings for each activity are totaled, then averaged. For example:

At LOCATION 2 on the river:	WATER TEMPERATURE	1.	84°F
		2.	83°F
		3.	85°F
	TOTAL		252
	AVERAGE		84°F

84°F is the AVERAGE water temperature for the readings made at LOCATION 2

Here is how it is done:

1. add the three readings 84°F, 83°F, and 85°F together
2. the total is 252
3. divide 252 by 3 (3 = the number of water temperature readings taken)
4. this answer is the AVERAGE

The following DATA is the average for each location:

	RIVER LOCATION: 1	2	3	4
DEPTH in centimeters (cm)	125 cm	130 cm	285 cm	123 cm
WATER TEMPERATURE in Fahrenheit (°F)	84°F	85°F	81°F	85°F
SALINITY Parts per 1000 (ppt)	31	32	34	32

BOTTOM TYPE

mud =

shell =

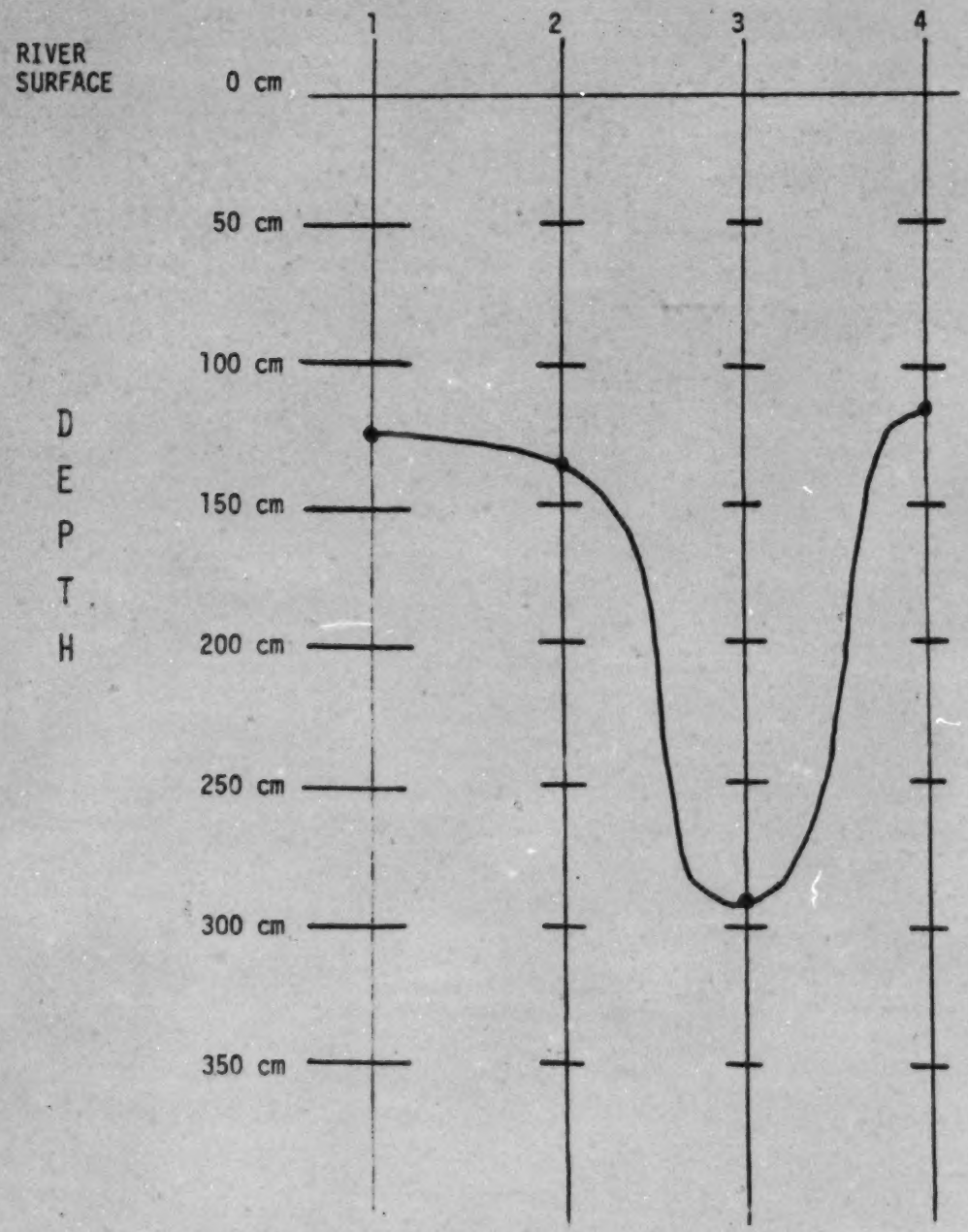
sand =

mixture =

A plotted profile is drawn for each PHYSICAL CONDITION investigated at the 4 river locations. DATA taken for water depth, water temperature and salinity has been plotted on graphs. Each graph then is a profile of that condition across the river.

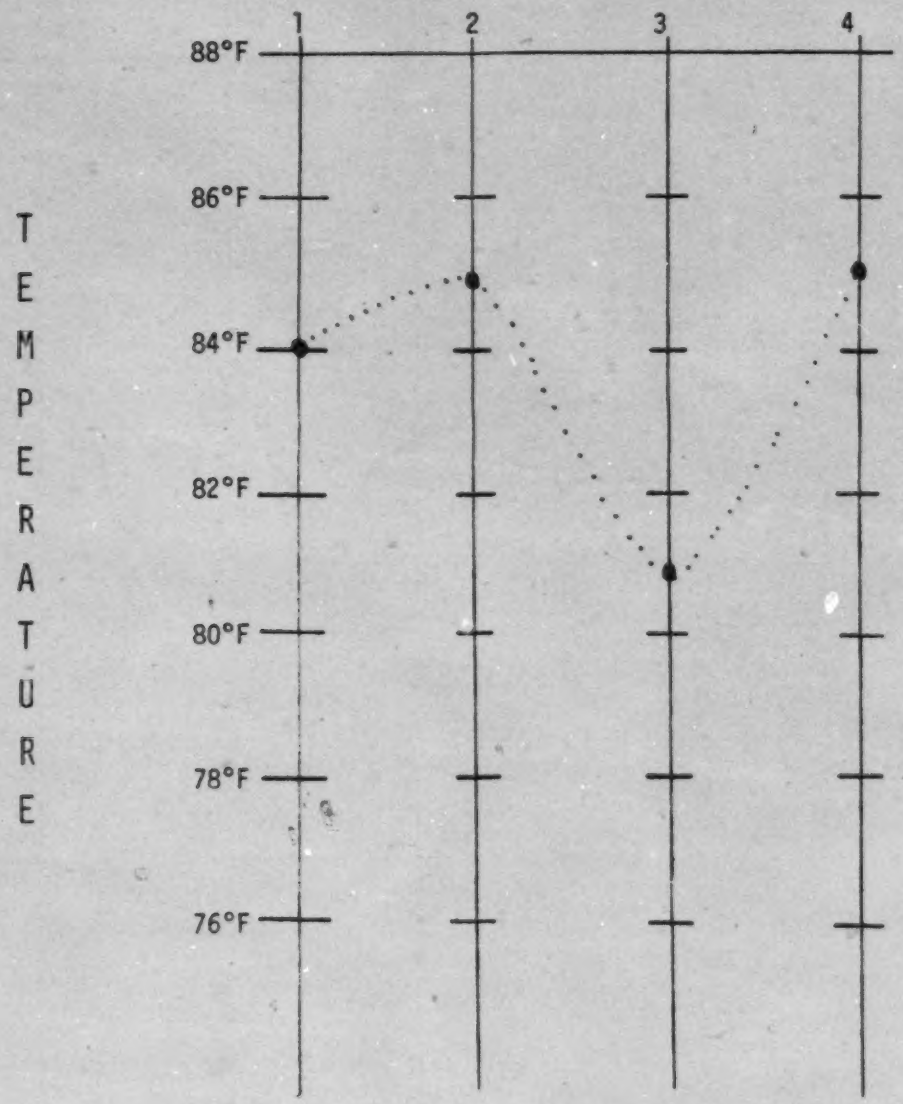
PHYSICAL CONDITION: WATER DEPTH

RIVER LOCATIONS (cm = centimeters)



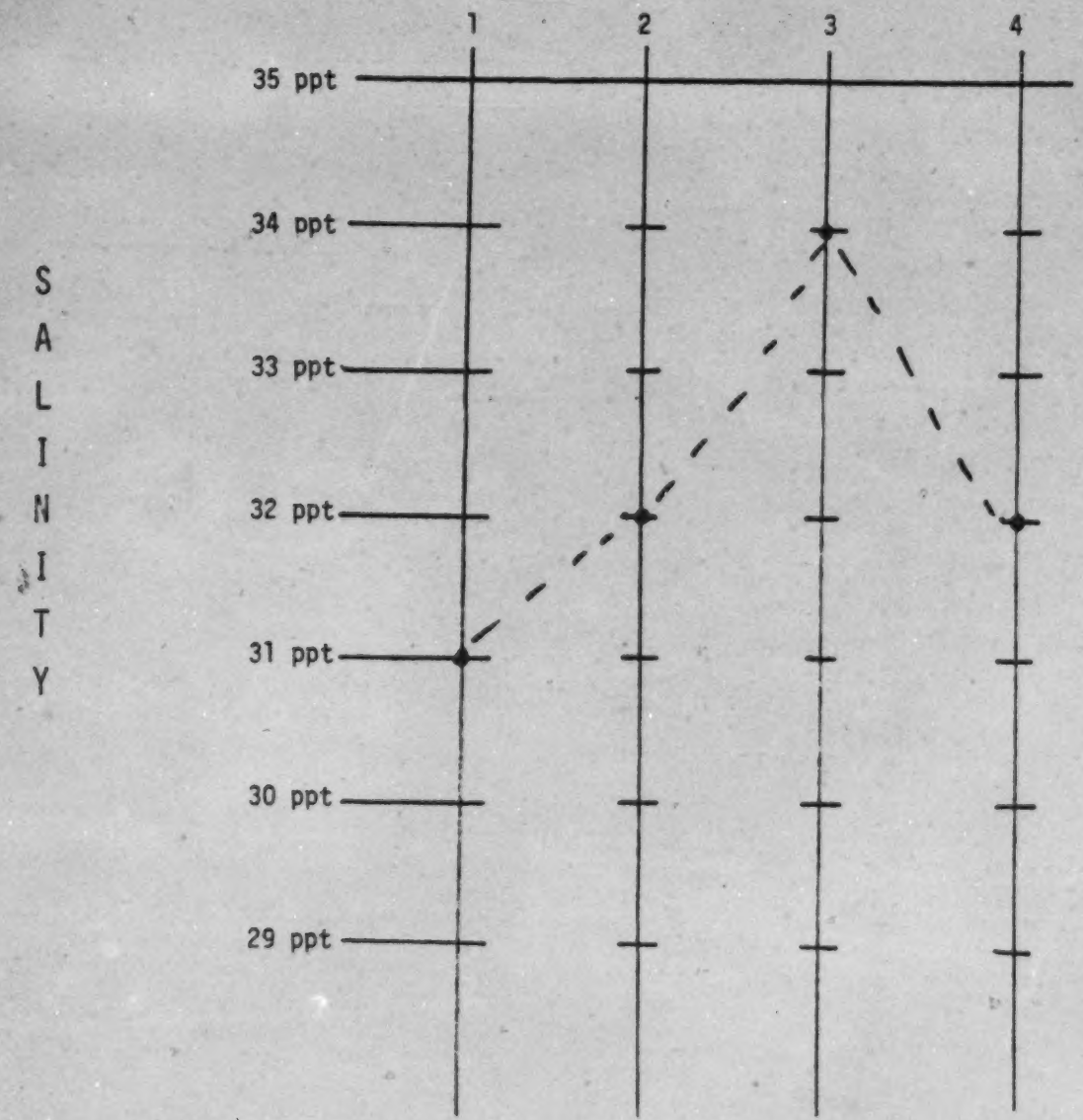
PHYSICAL CONDITION: WATER TEMPERATURE

RIVER LOCATIONS (°F = degrees Fahrenheit)



PHYSICAL CONDITION: SALINITY

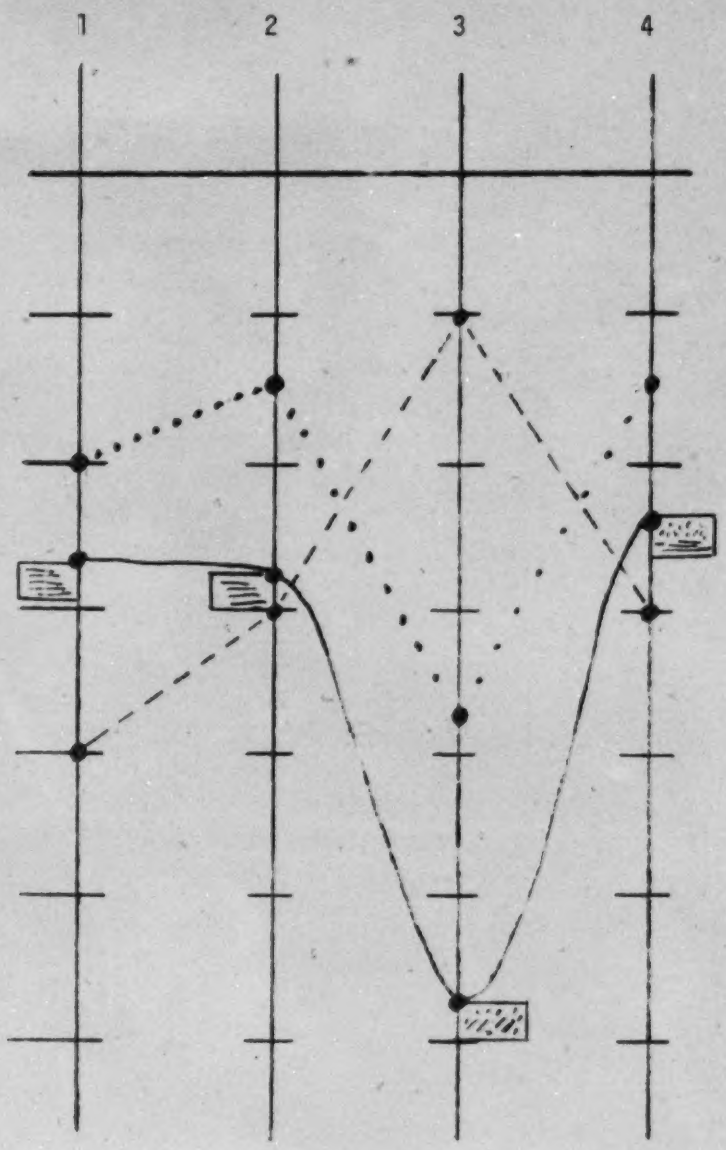
RIVER LOCATIONS (ppt. = parts of salt per 1000 parts of water)



AN INDIAN RIVER PROFILE

This chart is a PROFILE OF THE 3 PHYSICAL CONDITIONS investigated and recorded for 4 locations on the river.

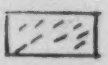
RIVER LOCATIONS

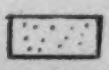


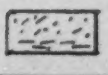
WATER TEMP	RIVER SURFACE	SALINITY
88°F	0 cm	35 ppt
86°F	50 cm	34 ppt
84°F	100 cm	33 ppt
82°F	150 cm	32 ppt
80°F	200 cm	31 ppt
78°F	250 cm	30 ppt
76°F	300 cm	29 ppt

KEY TO PROFILE

mud =

shell = 

sand = 

mixture = 

——— = depth

····· = temperature

----- = salinity

Perhaps you can follow these charts along and see them all put together in one PROFILE. Don't worry if you can't.

You will be doing a PROFILE at the Center for the DATA you collect.

See you on the river for a good look at "what makes the river tick".

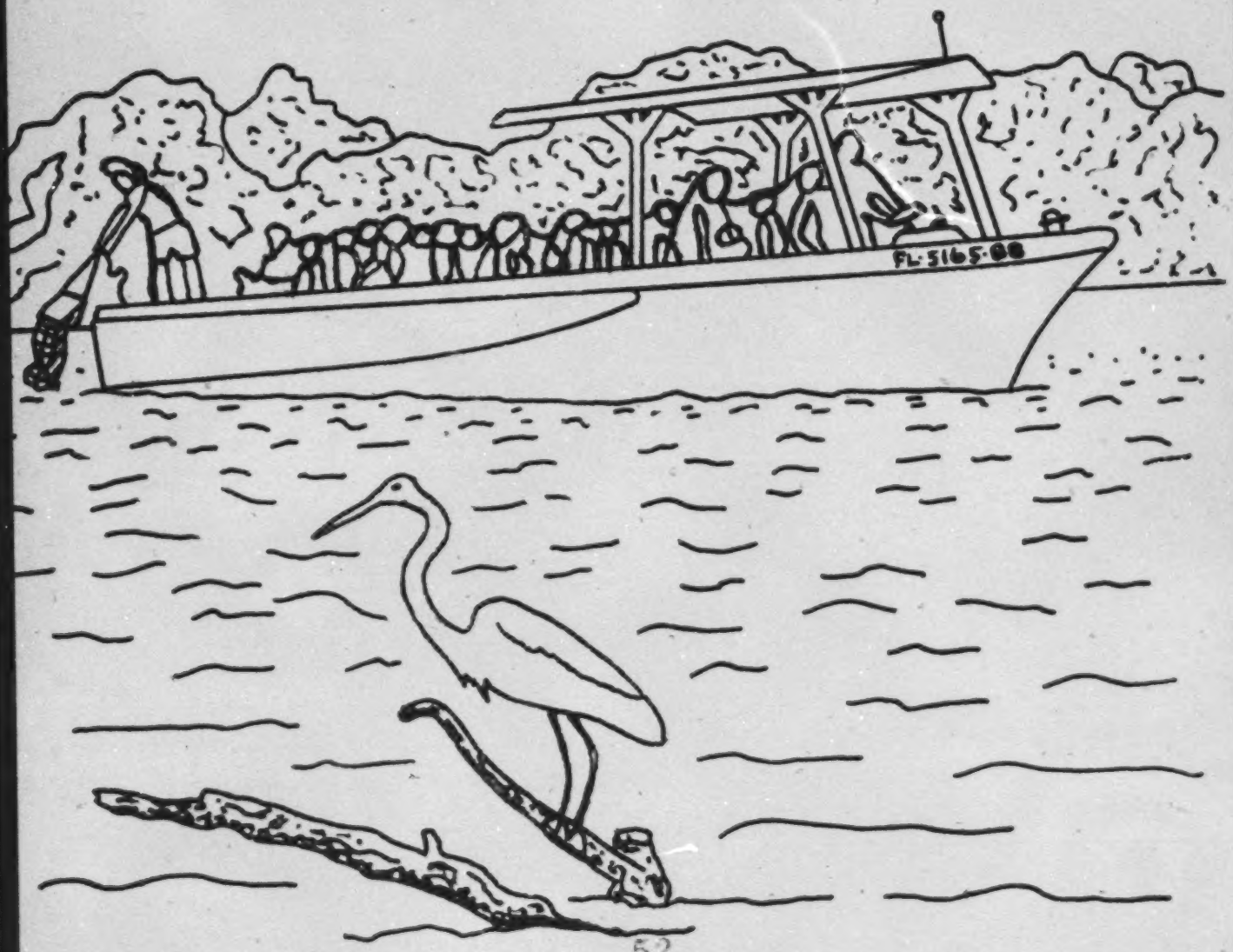
GLOSSARY

PROFILE	- a side view of anything
PHYSICAL CONDITIONS OR FACTORS	- the characteristics, properties or nature of non-living things like temperature
DATA	- recorded information
SALINITY	- amount of salt in water
AVERAGE	- the representative amount of something
PLOT	- to put information on a graph
GRAPH	- a picture that shows a relationship between 2 numbers
CENTIMETER (cm)	- a unit of length, 100 cm = 1 meter
FAHRENHEIT (°F)	- a temperature scale (water freezes at 32°F and boils at 212°F)

Martin County Schools
Environmental Studies Center
205 South Indian River Drive
Jensen Beach, Fla. 33457

Sixth Grade

BOAT EQUIPMENT

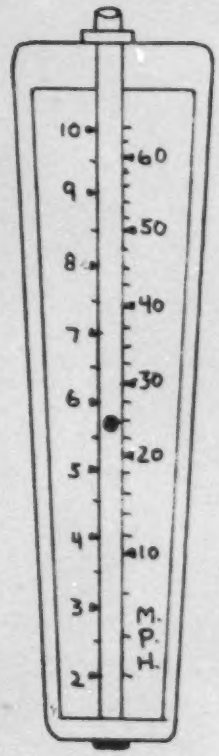


INTRODUCTION TO THE BOAT EQUIPMENT

This booklet will acquaint you with the equipment you will be using on board the "River Scout". The equipment enables you to investigate the Physical Factors of the Indian or St. Lucie River. You will have a chance to use each piece. Study them carefully so you will be ready to get right to work.

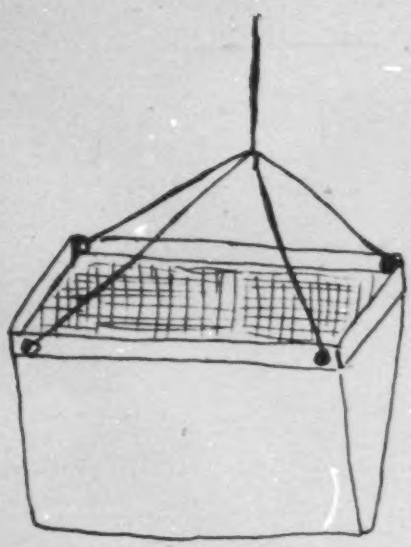
LIST OF EQUIPMENT

BOTTOM GRAB
DREDGE
BINOCULARS
DEPTH LINE
HYDROMETER
SECCHI DISC
REFRACTOMETER
HAND BEARING COMPASS
FOREL ULE SCALE
ANEMOMETER



ANEMOMETER

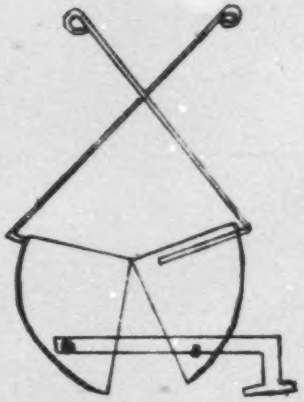
The anemometer is an instrument that measures the velocity or speed of the wind. On the back there are 2 holes. These are pointed directly into the wind. When you look at the scale, notice a tiny ball that moves up and down in the center. If the wind speed is less than 10 mph (miles per hour) read the scale on the left. If the wind speed is 10 mph or over place your finger over the hole on the top and you read the scale on the right.



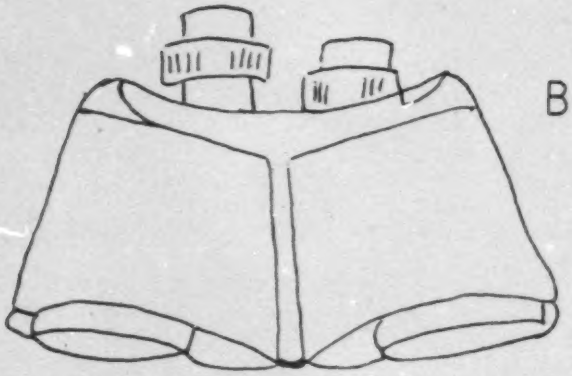
This instrument is a combination of two bags, a large net bag inside a canvas bag. If pulled slowly across the bottom of the river, the "goodies" within will represent a sample of the life and <u>debris</u> found in that area.

BOTTOM DREDGE

This instrument is used to sample the material that makes up the bottom of a river, lake or ocean. It will "grab" at the bottom when you give the rope a quick jerk just after it hits bottom.



BOTTOM GRAB

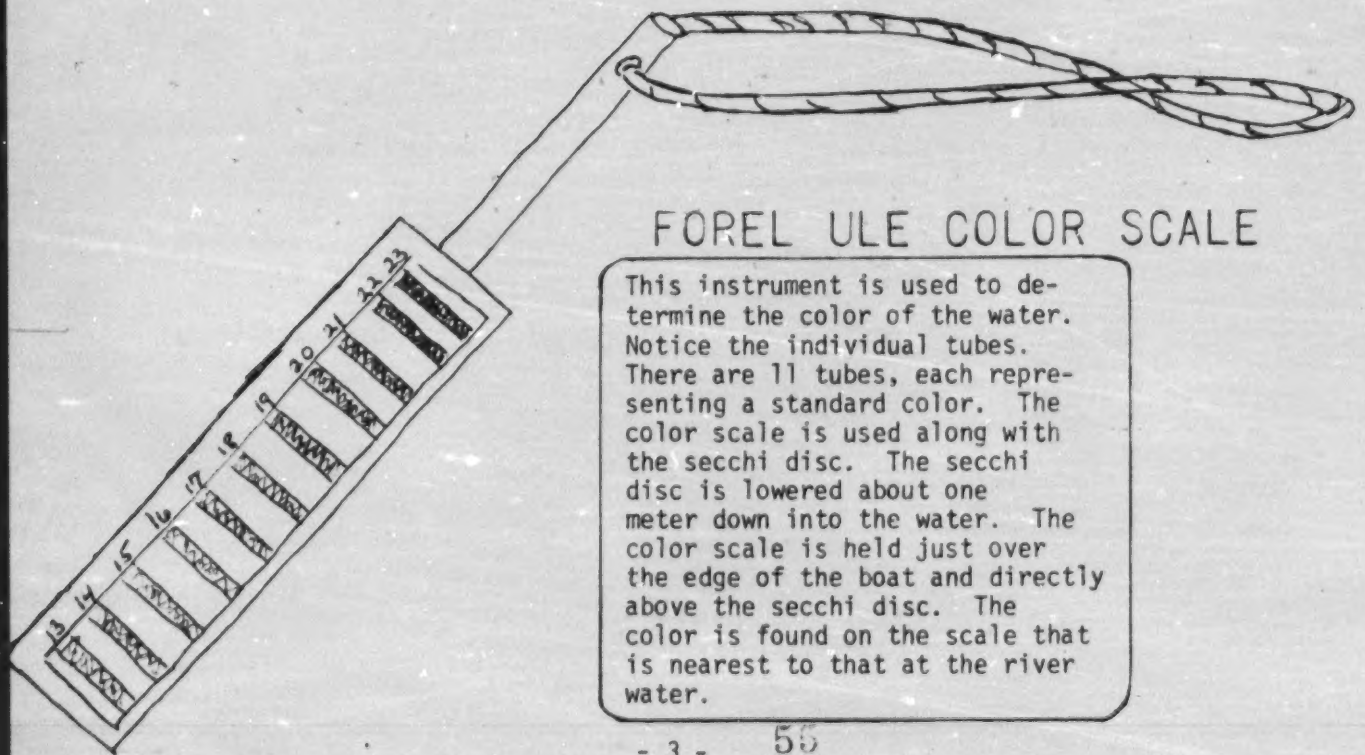


BINOCULARS

These glasses bring an object closer to your eyes. The glasses used in the boat are especially made to be waterproof and to float. You can adjust each lens by turning the eye piece.

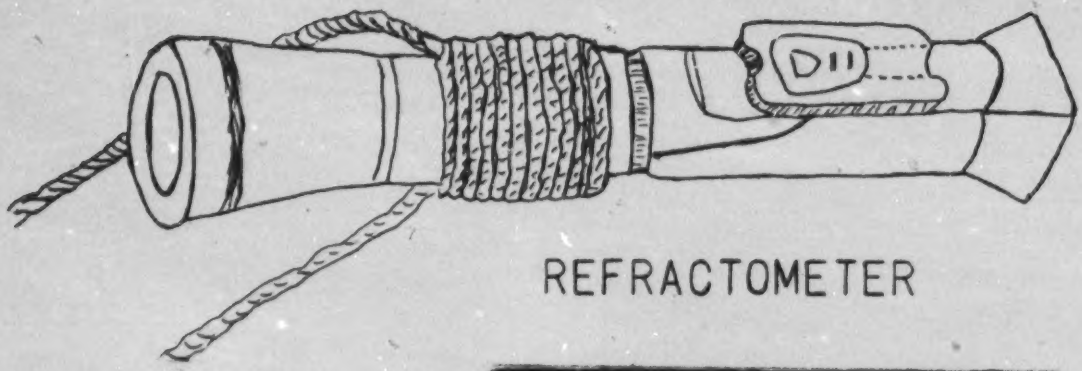
SECCHI DISC

This instrument is used to find out how turbid the water is. The disc is white. It is lowered into the water until it is on the bottom then it is pulled up slowly unitl it is barely visible. The distance is then measured from the surface of the water down to the disc. Then it is dropped to the bottom and pulled up until it just barely reappears. The distance from the water's surface down to the disc is again measured. The average of these two measurements is an indication of the turbidity of the water.



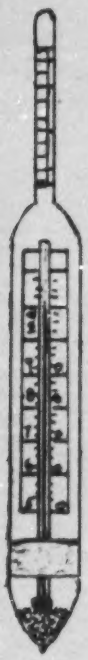
FOREL ULE COLOR SCALE

This instrument is used to determine the color of the water. Notice the individual tubes. There are 11 tubes, each representing a standard color. The color scale is used along with the secchi disc. The secchi disc is lowered about one meter down into the water. The color scale is held just over the edge of the boat and directly above the secchi disc. The color is found on the scale that is nearest to that at the river water.



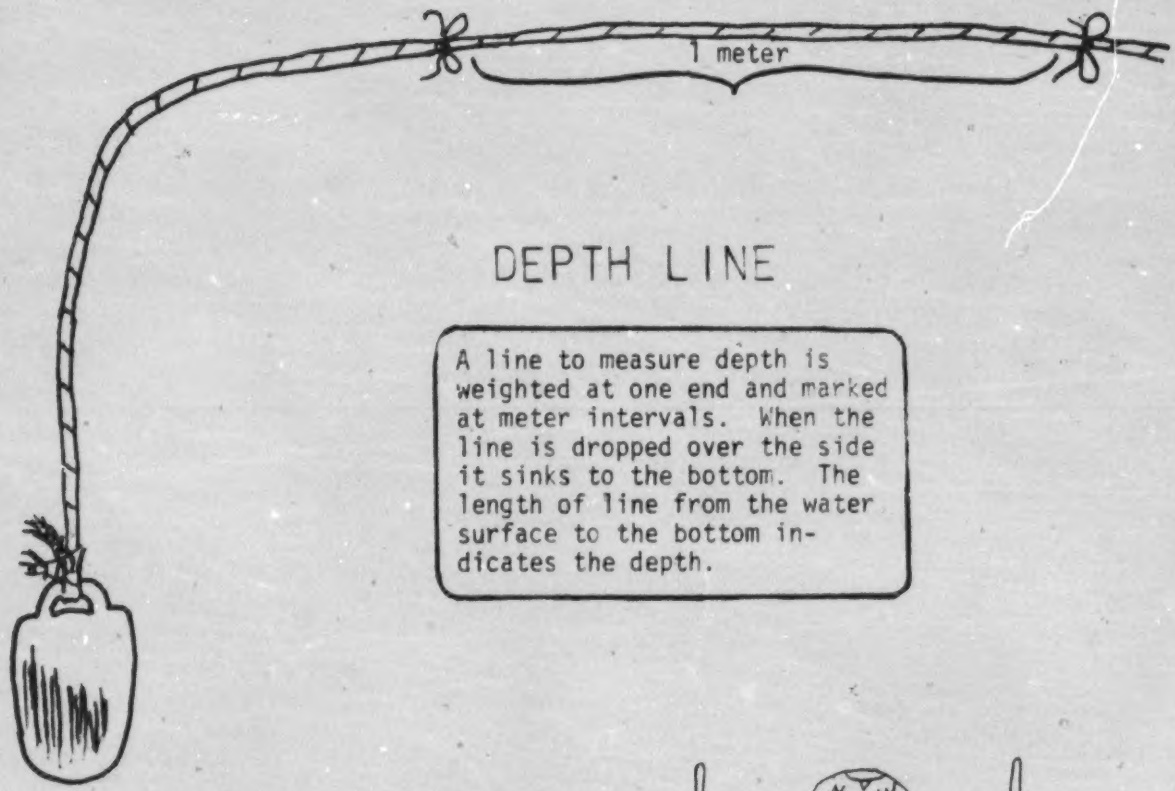
REFRACTOMETER

This instrument is used to find the salinity of the water. Light refracts or bends as it passes from air into water. The salt in the water increases the bending and that is what is measured. The readings are more accurate than those of the hydrometers we use, but its cost is too great to allow for general class use. We use one to check the readings you obtain with your hydrometers.



HYDROMETER

This instrument is probably a bit different from those you have seen or used before. The bottom part is a regular thermometer used to find water temperature. Read it in Fahrenheit degrees. The top part of the bulb includes another scale that can be used to find the salinity (amount of salt in a 1000 parts of water). When the Hydrometer is put in water, it floats. The saltier the water, the higher it floats. The water level is read from the Hydrometer scale. It and the water temperature are used to locate on a chart the water's salinity. There is a chart with each Hydrometer.



DEPTH LINE

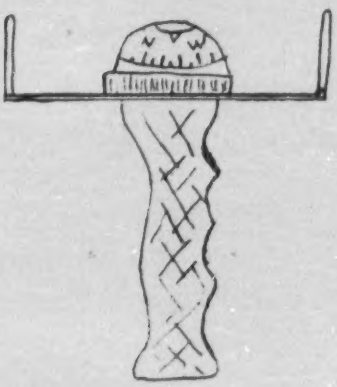
A line to measure depth is weighted at one end and marked at meter intervals. When the line is dropped over the side it sinks to the bottom. The length of line from the water surface to the bottom indicates the depth.

HAND BEARING COMPASS

This instrument is used to determine your position. On board the boat you will use it to determine the boat's position on the river.

In use, the compass is aimed like a gun at a fixed object (such as a church steeple, bridge, channel marker, tree, etc.). With the sights lined up on the target, you read the direction in degrees as indicated by the compass. This is called a "bearing."

To locate the boat's position correctly, you must take a"bearing" on at least 2 fixed objects. Three or more "bearings" are better.



SIDE VIEW "A"

FRONT VIEW "B"

6th Grade Slide Presentation

"Equipment"

TEACHER - Turn on projector with "Focus" slide. Turn on tape. Advance slides at the sound of the audible note (or, if you are reading this script, at the asterisk (*) where indicated.) Narration is in CAPITAL letters.

1. Focus *

2. "Credits" slide *

3. "An Environmental Study Unit on River Investigations" *

4. "Equipment" THERE IS MUCH EQUIPMENT USED ON BOARD THE RIVER SCOUT TO INVESTIGATE THE PHYSICAL FACTORS OF THE RIVER. EACH OF YOU ON BOARD WILL HAVE AN OPPORTUNITY TO USE THE EQUIPMENT, SO LET'S INTRODUCE YOU TO IT. *

5. TO BEGIN WITH WE TAKE A SAMPLE OF THE BOTTOM USING AN INSTRUMENT CALLED A BOTTOM GRAB. THE GRAB IS SET AND CAREFULLY LOWERED OVER THE SIDE. AFTER THE GRAB HITS BOTTOM, TO MAKE SURE YOU HAVE A GOOD SAMPLE YOU GIVE THE LINE A FEW QUICK JERKS BEFORE YOU SLOWLY BRING IT UP. THEN YOU EMPTY THE CONTENTS INTO A SCREEN SO IT CAN BE EXAMINED. *

6. HOW ABOUT A SAMPLE OF THE LIFE (AND DEBRIS) FOUND ALONG THE RIVER BOTTOM? FOR THAT WE USE A BIOLOGICAL DREDGE. THE DREDGE IS REALLY TWO BAGS: A CANVAS BAG ON THE OUTSIDE AND A NET BAG ON THE INSIDE, AS SEEN IN PICTURE "A". TO LOWER THE DREDGE OVERBOARD THE BOAT MUST BE SLOWED DOWN. THE DREDGE IS PULLED ALONG BEHIND THE BOAT A SHORT DISTANCE. IT IS THEN CAREFULLY HAULED ABOARD AND ITS CONTENTS EMPTIED INTO A SCREEN LIKE THE ONE IN PICTURE "B" FOR YOU TO EXAMINE. *

7. PERHAPS MOST OF YOU KNOW WHAT BINOCULARS ARE. THEY ARE GLASSES THAT BRING OBJECTS CLOSE TO YOUR EYES. *

8. THE EYEPIECE CAN BE TURNED TO ADJUST TO YOUR OWN EYES. THE BINOCULARS USED ON THE BOAT ARE WATERPROOF. *

9. WHAT IS A DEPTH LINE? A DEPTH LINE IS A ROPE USED TO MEASURE THE DEPTH OF THE WATER. THE ROPE IS WEIGHTED ON ONE END AND DIVIDED INTO METERS ALONG ITS LENGTH. *

10. THE DEPTH LINE IS LOWERED OVER THE SIDE OF THE BOAT. THE DEPTH IS MEASURED FROM THE TOP OF THE WATER IN CENTIMETERS, WITH 100 CENTIMETERS EQUALLING 1 METER. *

11. HAVE YOU SEEN THIS INSTRUMENT BEFORE? IT'S A HYDROMETER - AN INSTRUMENT WE CAN USE TO MEASURE THE SALINITY OF THE WATER. THIS HYDROMETER HAS A SCALE AT THE TOP AND A THERMOMETER INSIDE THE BULB. WHEN IT IS PUT INTO A CONTAINER WITH A SAMPLE OF RIVER WATER, IT FLOATS. *

12. THE LEVEL OF WATER ON THE HYDROMETER INDICATES HOW MUCH ROOM IS BEING TAKEN UP BY THE HYDROMETER IN THE SALT WATER. IF THE HYDROMETER SINKS, IS THE SALINITY HIGH OR LOW? REMEMBER THE SALT IS TAKING UP ROOM. THE HYDROMETER WATER LEVEL AND THE WATER TEMPERATURE ARE RECORDED. THIS INFORMATION IS USED TO FIND THE SALINITY OF THE WATER SAMPLE ON A CHART IN THE HYDROMETER KIT. THE HYDROMETER READING IN THE PICTURE IS 1.020. *

13. DO YOU KNOW ANOTHER WAY TO MEASURE SALINITY? WE USE THE REFRACTION OR BENDING OF LIGHT IN WATER. LIGHT BENDS MORE WHILE PASSING THROUGH SALT WATER THAN IT DOES WHILE PASSING THROUGH FRESH WATER. THE MORE SALT IN THE WATER THE MORE THE LIGHT BENDS. THE REFRACTOMETER YOU WILL BE USING IS CALIBRATED TO MEASURE HOW MUCH SALT THERE IS IN A CERTAIN AMOUNT OF WATER. A DROP OF THE WATER SAMPLE IS PLACED ON THE GLASS PLATE ON THE TOP OF THE REFRACTOMETER. *

14. THE AMOUNT OF SALT IN THE SAMPLE OF WATER IS READ ON THE SCALE INSIDE. WHAT DO YOU THINK IS USED TO CLEAN THE GLASS PLATE AFTER EACH WATER SAMPLE IS READ? *

15. WHAT IS A SECCHI DISC? IT'S AN INSTRUMENT USED TO FIND OUT HOW TURBID OR CLOUDY THE WATER IS. *

16. THE WHITE DISC IS LOWERED INTO THE WATER UNTIL IT TOUCHES BOTTOM. THE DISC IS THEN SLOWLY RAISED UNTIL IT IS BARELY VISIBLE. THE ROPE ATTACHED TO THE SECCHI DISC IS DIVIDED INTO METERS LIKE THE DEPTH LINE. THE WATER'S TURBIDITY OR CLOUDINESS IS FOUND BY MEASURING THE DISTANCE FROM THE TOP OF THE WATER TO THE DISC. *

17. HOW CAN YOU ACCURATELY DESCRIBE THE COLOR OF THE RIVER WATER? BY USING THE FOREL ULE SCALE. THE TUBES OF WATER REPRESENT A STANDARD RANGE OF WATER COLORS AROUND THE WORLD. *

18. THE SCALE IS HELD OVER THE SIDE OF THE BOAT JUST ABOVE THE SECCHI DISC. YOU FIND THE NUMBERED TUBE THAT BEST MATCHES THE COLOR OF THE RIVER WATER. *

19. TO DETERMINE EXACTLY WHERE YOU ARE ON THE RIVER, YOU USE THIS HAND BEARING COMPASS. YOU HOLD IT LIKE A GUN AND AIM IT AT A PERMANENT OBJECT SUCH AS A CHANNEL MARKER, A BRIDGE OR A BUILDING. *

20. THERE ARE SIGHTING LINES ON THE COMPASS AS SEEN IN PICTURE "B". THESE SIGHTS ARE LINED UP ON THE OBJECT AT WHICH YOU ARE AIMING. EACH DIVISION ON THE COMPASS SCALE IS EQUAL TO 5 DEGREES. THE BEARING ON THE COMPASS IN THE PICTURE IS BETWEEN 180 AND 185 DEGREES, SOUTH. *

21. WE USE AN ANEMOMETER TO MEASURE THE SPEED OR VELOCITY OF WIND. ON THE BACK OF THE ANEMOMETER THERE ARE TWO HOLES. THEY ARE HELD DIRECTLY INTO THE WIND. IN THE CENTER OF THE ANEMOMETER THERE IS A BALL THAT MOVES TO INDICATE THE WIND'S SPEED. YOU READ THE SCALE ON THE LEFT IF THE WIND SPEED IS BELOW 10 MPH. THE WIND SPEED IN PICTURE "B" IS 4 MPH. IF THE WIND SPEED IS GREATER THAN 10 MPH, YOU PUT YOUR FINGER OVER THE HOLE ON THE TOP OF THE ANEMOMETER AND READ THE SCALE ON THE RIGHT. NOW THE WIND SPEED SHOWN IN PICTURE "B" IS 12 MPH. *

22. HAVE YOU USED AN INSTRUMENT LIKE THIS BEFORE? IT'S A STEREOSCOPE, AN INSTRUMENT THAT MAGNIFIES A SMALL OBJECT WHILE ALLOWING YOU TO VIEW THE OBJECT IN THREE DIMENSIONS. THE STEREOSCOPE ON THE "RIVER SCOUT" MAGNIFIES OBJECTS 10 TIMES. YOU

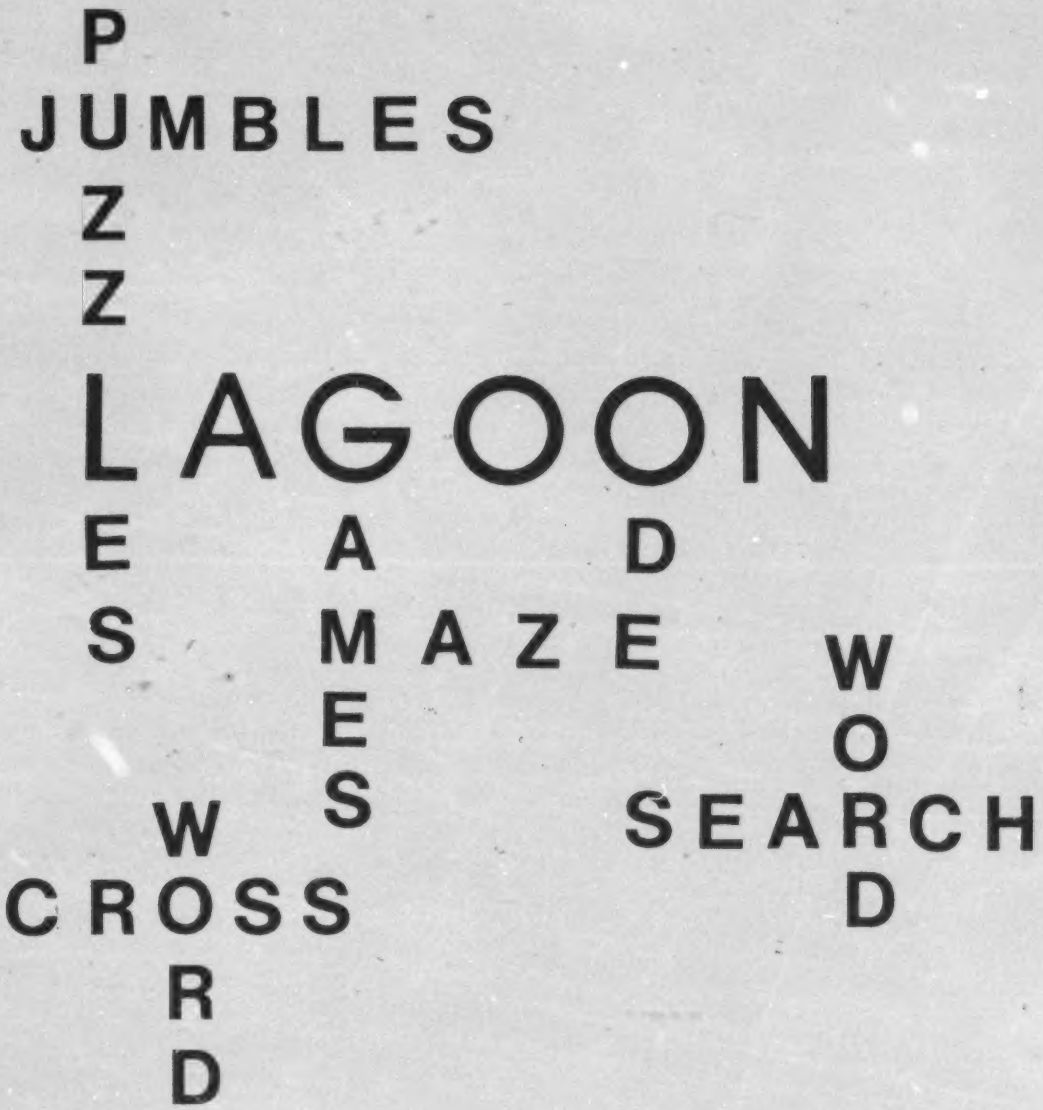
CAN EXAMINE SOME OF THE MATERIAL FROM THE BOTTOM GRAB AND DREDGE FOR MICROSCOPIC LIFE UNDER THE STEREOSCOPE. *

23. TO RECORD ALL OF YOUR FINDINGS YOU WILL USE DATA SHEETS. THESE SHEETS ARE LOCATED AT EACH STATION ON THE "RIVER SCOUT". RECORDING YOUR INFORMATION IS THE MOST IMPORTANT PART OF YOUR INVESTIGATION OF PHYSICAL FACTORS OF THE RIVER. UNLESS YOU RECORD YOUR INFORMATION ON DATA SHEETS, IT WILL BE LOST OR FORGOTTEN. *

24. MUCH OF THE INFORMATION YOU WILL FIND IS PART OF A NEW AND ORIGINAL STUDY OF THE RIVERS. THE STUDENTS ON BOARD THE "RIVER SCOUT" ARE THE PIONEERS IN OUR RIVER'S INVESTIGATION. *

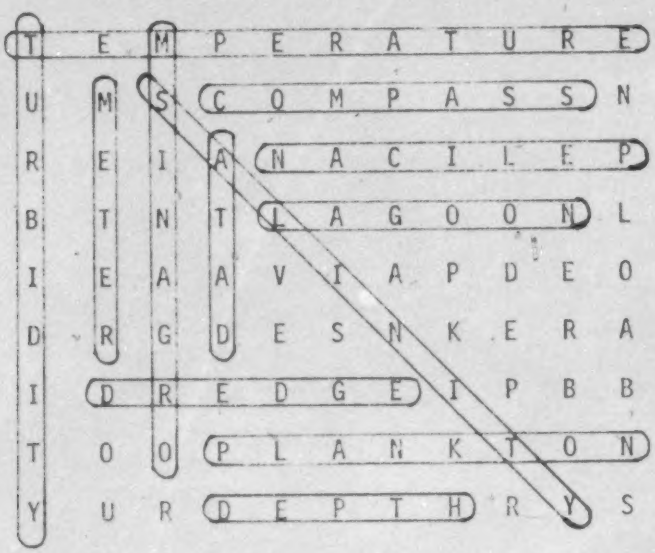
25. The End.

TEACHER - Please rewind the tape for its next use. Thanks.


P
JUMBLES
ZZZ
LAGOON
E
S
A
M
E
S
D
MAZE
W
O
SEARCH
D
W
CROSS
O
R
D

RIVER SLEUTH

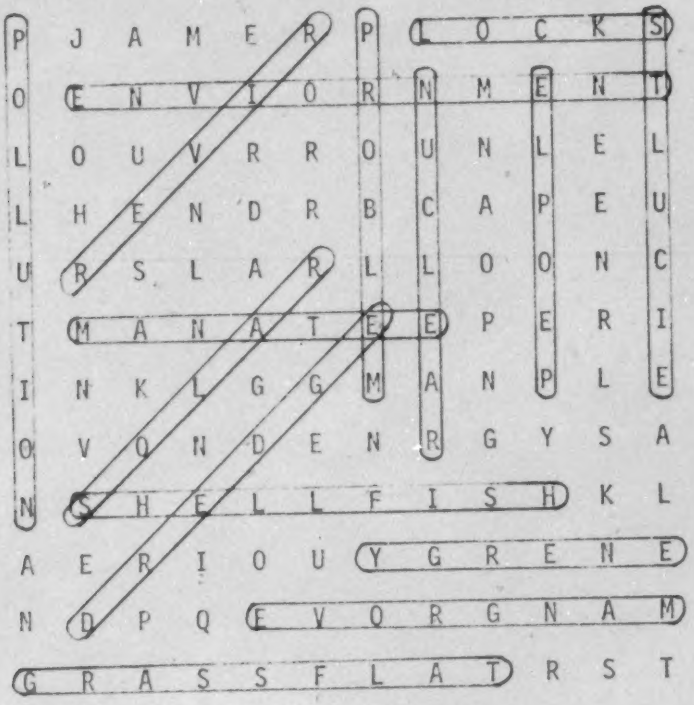
Directions: Find the listed words in the diagram. They run in all directions - forward, backward, up, down, diagonally.



salinity
temperature
lagoon
data
turbidity
meter
pelican
depth
compass
dredge
organism
plankton

PROBLEM SLEUTH

Directions: Find the listed words in the diagram. They run in all directions - forward, backward, up, down, diagonally.


P J A M E R P L O C K S
O E N V I O R N M E N T
L O U V R R O U N L E L
L H E N D R B C A P E U
U R S L A R L L O O N C
T M A N A T E E P E R I
I N K L G G M A N P L E
O V O N D E N R G Y S A
N S H E L L F I S H K L
A E R I O U Y G R E N E
N D P Q E V O R G N A M
G R A S S F L A T R S T

problem
environment
nuclear
energy
people
grassflat
mangrove
dredge
pollution
shellfish
solar
manatee
St. Lucie
locks
river

BREAK THE CODE

Each of the following coded sentences has to do with your trip to the Center. In numbers 1 to 4 the code is the same:

C = T
Y = E
F = R

In numbers 1 to 3 the decoded letter has been written in. You do it for number 4. Break the code. Clues are at the side.

(1) C L Y S F Y S A Y S F P A A Y S

T H E D R E D G E D R A G G E D

H Y L R G S

B E H I N D.

(2) C L Y S Y O C L N R G Y

T H E D E P T H L I N E

S F T O O Y S S Y Y O

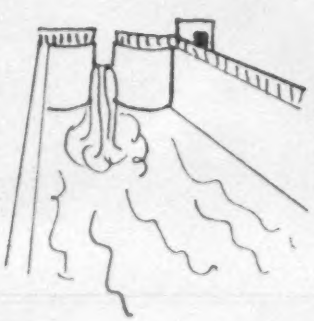
D R O P P E D D E E P.

(3) C L Y N T Z E B P F Y K O

T H E L O C K S A R E U P

C R A L C

T I G H T.



(4) T K F F R X Y F' B B P N C

OUR RIVERS SALT

R B L R A L

IS HIGH.

The code for number 5 is different: T = S
R = E
There is no clue. B = T

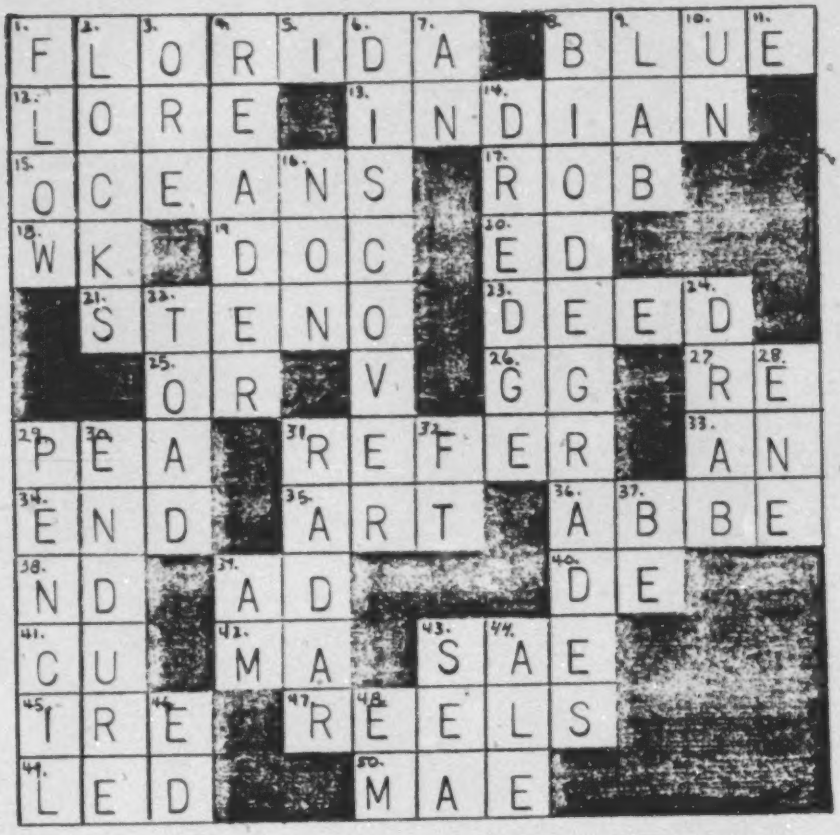
(5) T S M C P A R A X M R B

ST. LUCIE INLET

D R R B T B O R T R Q

MEETS THE SEA.

INDIAN RIVER
CROSSWORD



Indian River Crossword (cont'd)

ACROSS

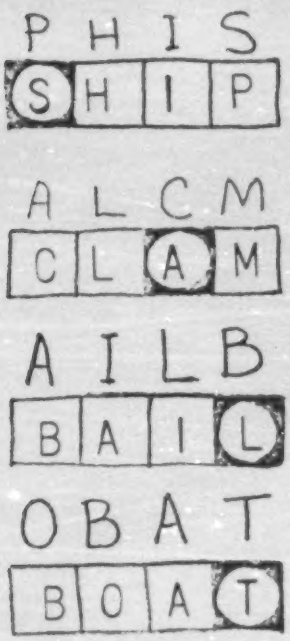
1. state
8. type of crab
12. accumulated knowledge, facts
13. river name
15. large bodies of water
17. to steal
18. abbreviation for week
19. slang for doctor
20. abbreviation for Edward
21. stenographer, abbreviation
23. an act
25. either --
26. abbreviation for green giant
27. musical note
29. vegetable
31. to direct to a source
33. indefinite article
34. finish
35. a trade or craft
36. superior of an abbey
38. abbreviation for N.W. state
39. an advertisement
40. French preposition
41. chemical symbol for copper
42. mother
43. grade of oil
45. anger
47. staggers
49. past tense of lead
50. girl's name

DOWN

1. move or run freely
2. gates that hold back water
3. mineral to be mined
4. one who reads
5. 1st person pronoun
6. to find
7. indefinite article
8. break down biologically
9. abbreviation for laboratory
10. United Nations
14. equipment used to mine or suck-up under water
16. indicates not
22. warty reptile
24. faded, dull
28. wind direction
29. what you write data with
30. to last, hold out
31. detecting distant objects by analysis of radio waves
32. abbreviation foot
37. to exist
39. part of to be
43. body of salt water
44. alcoholic beverage
46. ending denoting past tense
48. comparative ending

JUMBLE PUZZLES

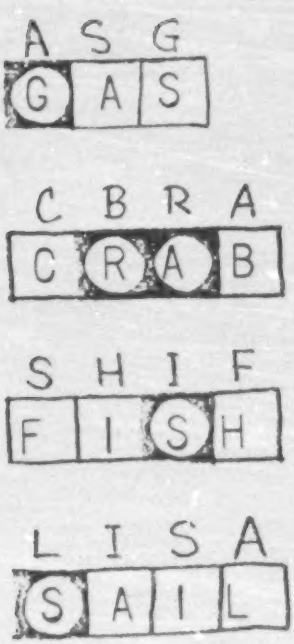
#1



CLUE: A PHYSICAL FACTOR OF THE INDIAN RIVER

SURPRISE ANSWER HERE:

#2

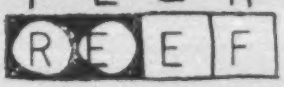


CLUE: A PRODUCER IN THE RIVER

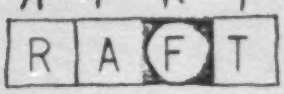
SURPRISE ANSWER HERE:

#3

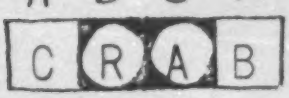
F E E R



A F R T

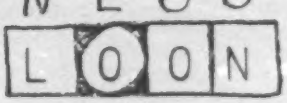


A B C R



T C A C H

N L O O



R E T E M

CLUE: AN INSTRUMENT TO MEASURE AMOUNT OF SALT IN A LIQUID

SURPRISE ANSWER HERE:

Martin County Schools'
Environmental Studies Center
2900 N. E. Indian River Drive
Jensen Beach, FL 33457

WATER SALINITY DATA SHEET

REFRACTOMETER

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION 1

TEAM _____

SAMPLE #	DEPTH	SALINITY ppt.

RIVER LOCATION 2

TEAM _____

SAMPLE #	DEPTH	SALINITY ppt.

RIVER LOCATION 3

TEAM _____

SAMPLE #	DEPTH	SALINITY ppt.

RIVER LOCATION 4

TEAM _____

SAMPLE #	DEPTH	SALINITY ppt.

WATER TEMPERATURE AND SALINITY DATA SHEET

HYDROMETER

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION

1

TEAM _____

SAMPLE #	DEPTH	READING	TEMP.	SALT ppt.

RIVER LOCATION

2

TEAM _____

SAMPLE #	DEPTH	READING	TEMP.	SALT ppt.

RIVER LOCATION

3

TEAM _____

SAMPLE #	DEPTH	READING	TEMP.	SALT ppt.

RIVER LOCATION

4

TEAM _____

SAMPLE #	DEPTH	READING	TEMP.	SALT ppt.

RIVER BOTTOM DATA SHEET

BOTTOM GRAB

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION 1

TEAM _____

BOTTOM TYPE	SAMPLE DESCRIPTION

RIVER LOCATION 2

TEAM _____

BOTTOM TYPE	SAMPLE DESCRIPTION

RIVER LOCATION 3

TEAM _____

BOTTOM TYPE	SAMPLE DESCRIPTION

RIVER LOCATION 4

TEAM _____

BOTTOM TYPE	SAMPLE DESCRIPTION

RIVER BOTTOM DATA SHEET

BOTTOM DREDGE

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION 1

TEAM _____

ANIMALS	PLANTS	MAN'S DEBRIS

RIVER LOCATION 2

TEAM _____

ANIMALS	PLANTS	MAN'S DEBRIS

RIVER LOCATION 3

TEAM _____

ANIMALS	PLANTS	MAN'S DEBRIS

RIVER LOCATION 4

TEAM _____

ANIMALS	PLANTS	MAN'S DEBRIS

BOTTOM DEPTH DATA SHEET

DEPTH SOUNDER

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION 1

TEAM _____

#	DEPTH	#	DEPTH	#	DEPTH
TOTAL		TOTAL		TOTAL	
AVG.		AVG.		AVG.	

RIVER LOCATION 2

TEAM _____

#	DEPTH	#	DEPTH	#	DEPTH
TOTAL		TOTAL		TOTAL	
AVG.		AVG.		AVG.	

RIVER LOCATION 3

TEAM _____

#	DEPTH	#	DEPTH	#	DEPTH
TOTAL		TOTAL		TOTAL	
AVG.		AVG.		AVG.	

RIVER LOCATION 4

TEAM _____

#	DEPTH	#	DEPTH	#	DEPTH
TOTAL		TOTAL		TOTAL	
AVG.		AVG.		AVG.	

WATER COLOR & TURBIDITY DATA SHEET

SECCHI DISK

FORE-ULE COLOR SCALE

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION 1

TEAM _____

#	DEPTH	COLOR	#	DEPTH	COLOR	#	DEPTH	COLOR
TOTAL			TOTAL			TOTAL		
AVG.			AVG.			AVG.		

RIVER LOCATION 2

TEAM _____

#	DEPTH	COLOR	#	DEPTH	COLOR	#	DEPTH	COLOR
TOTAL			TOTAL			TOTAL		
AVG.			AVG.			AVG.		

RIVER LOCATION 3

TEAM _____

#	DEPTH	COLOR	#	DEPTH	COLOR	#	DEPTH	COLOR
TOTAL			TOTAL			TOTAL		
AVG.			AVG.			AVG.		

RIVER LOCATION 4

TEAM _____

#	DEPTH	COLOR	#	DEPTH	COLOR	#	DEPTH	COLOR
TOTAL			TOTAL			TOTAL		
AVG.			AVG.			AVG.		

AIR SPEED AND TEMPERATURE DATA SHEET

ANEMOMETER - THERMOMETER

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION 1

TEAM _____

#	DIRECTION	HIGH	LOW	AVERAGE	TEMP.

RIVER LOCATION 2

TEAM _____

#	DIRECTION	HIGH	LOW	AVERAGE	TEMP.

RIVER LOCATION 3

TEAM _____

#	DIRECTION	HIGH	LOW	AVERAGE	TEMP.

RIVER LOCATION 4

TEAM _____

#	DIRECTION	HIGH	LOW	AVERAGE	TEMP.

RIVER LOCATION DATA SHEET

HAND BEARING COMPASS

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION 1

TEAM _____

OBJECT SIGHTED	BEARING 1	2	3

RIVER LOCATION 2

TEAM _____

OBJECT SIGHTED	BEARING 1	2	3

RIVER LOCATION 3

TEAM _____

OBJECT SIGHTED	BEARING 1	2	3

RIVER LOCATION 4

TEAM _____

OBJECT SIGHTED	BEARING 1	2	3

BIRD IDENTIFICATION DATA SHEET

FIELD GUIDE,

BINOCULARS

SCHOOL _____

GRADE _____

DATE _____

RIVER LOCATION 1

TEAM _____

BIRD	LOCATION	BIRD	LOCATION

RIVER LOCATION 2

TEAM _____

BIRD	LOCATION	BIRD	LOCATION

RIVER LOCATION 3

TEAM _____

BIRD	LOCATION	BIRD	LOCATION

RIVER LOCATION 4

TEAM _____

BIRD	LOCATION	BIRD	LOCATION

TEST

Sixth Grade

PHYSICAL INTERRELATIONSHIPS

1. What regularly causes the salinity to INCREASE and DECREASE in the rivers?
   a. tides
   b. depth
   c. wind
   d. mud
2. What type of river bottom is usually found in areas of strong currents?
   a. mud
   b. algae
   c. sand
   d. grass
3. The Red and Black mangroves are found in what type of river bottom?
   a. sand
   b. mud
   c. grass
   d. shells
4. Why is the salinity always changing in the St. Lucie River?
   a. mangrove development
   b. fresh water run-off
   c. fast current
   d. muddy bottom
5. Which can have the MOST affect or influence on the turbidity of the rivers?
   a. temperature
   b. time of day
   c. tides
   d. salinity

Physical Interrelationships (cont'd)

6. Mangrove trees develop in tropic temperatures on shallow banks of the St. Lucie and Indian Rivers. Which of the following physical factors is also necessary for mangroves to grow?

   a. currents

   b. algae

   c. salt water

   d. sand

7. Sandy areas, tropical temperature and salt water are physical factors that influence the development of manatee and turtle grassflats in the Indian River. What other physical factor is also necessary?

   a. shallow water

   b. current

   c. fish

   d. turbid water

8. Seasons, tides and water depth influence the temperature of the rivers. Which of the following physical factors is also an influence on temperature?

   a. algae

   b. sandy bottom

   c. salinity

   d. sun

9. What season of the year is the salinity of the rivers the lowest?

   a. winter

   b. spring

   c. summer

   d. fall

10. What factor causes the st. Lucie River to have a salinity lower than the Indian River?

    a. algae growth

    b. temperature of water

    c. more sunlight

    d. run-off from land and canals

ENVIRONMENTAL PROBLEM TEST

11. It was necessary to construct canals and gates from Lake Okeechobee to the ocean because of:

    a. irrigation needs of farmers and citrus groves

    b. disastrous flooding

    c. reduced bird population

    d. fish kill in St. Lucie Canal

12. What factor could be a cause of pollution in the Indian and St. Lucie Rivers?

    a. tides

    b. decrease in pelicans

    c. too many grassflats

    d. overpopulation

13. What would be a major factor that could destroy mangroves along St. Lucie and Indian River?

    a. fresh water flooding

    b. high tides

    c. tropical climate

    d. a build-up of detritus

14. What could destroy the Indian River grassflat nurseries?

    a. tides

    b. seasons

    c. low salinity

    d. 50 mph winds

15. What is the prime reason for building new power plants in south Florida?

    a. temperature is just right

    b. plenty of land available

    c. gives people jobs

    d. an increased population

Environmental Problem Test (cont'd)

16. When the St. Lucie locks are opened for the purpose of lowering the depth of Lake Okeechobee the salinity of our rivers is lowered. What could be the effect on organisms in the river?

    a. no effect

    b. grow better without so much salt

    c. kill many of the organisms

    d. cause a high tide

17. The waste coolant water from the nuclear power plant on Hutchinson Island will be dumped into the ocean. One probable effect would be?

    a. cool the water

    b. change plant and animal life around dumping area

    c. no effect

    d. cause tide to change

18. Florida has a law that prevents the removal of the Red Mangrove because:

    a. the government likes mangroves

    b. the mangrove is a landbuilder and their removal could cause erosion

    c. builders actually prefer mangroves to be part of their landscape

    d. mangroves are the state tree

19. Grassflat destruction by dredge and fill in the Indian River Lagoon will:

    a. help clean up the river

    b. increase the fish population

    c. destroy game fishing

    d. do no harm

20. You cannot eat oysters and clams in the Indian River in most parts of Martin County because:

    a. the water is polluted

    b. the water is too warm

    c. birds destroy most of them

    d. the water is too salty

VOCABULARY TEST

21. Which two instruments are used to measure salinity?

    a. hydrometer - refractometer

    b. temperature - thermometer

    c. seine - sieve

    d. sighting compass - dredge

22. Which is a unit of length?

    a. data

    b. meter

    c. seine

    d. gram

23. Which of the following is an organism?

    a. fish gill

    b. crab

    c. seashell

    d. rock

24. What trees grow in the brackish waters along the southern coasts?

    a. oaks

    b. seagrapes

    c. cypress

    d. mangroves

25. What is an instrument used to gather living material and debris on the river bottom?

    a. dredge

    b. thermometer

    c. water sampler

    d. refractometer

Vocabulary Test (cont'd)

26. What is a side view of something called?

a. profile

b. data

c. sighting compass

d. sample

27. What is the information called when you go to the river and take temperatures, bottom samples and salinity?

a. graphs

b. data

c. sieves

d. charts

28. What is the cloudiness of the water called?

a. salinity

b. current

c. lagoon

d. turbidity

29. What decides the kind of plants and animals found in the Indian or St. Lucie River?

a. organisms

b. physical factors

c. shrimp

d. mangroves

30. What is the term for a body of water separated from open water by a sandbar?

For example - the Indian River

a. lake

b. pond

c. lagoon

d. estuary

DATA TEST

USE THE THREE CHARTS ON THE NEXT PAGE TO FIND YOUR ANSWERS TO THE FOLLOWING QUESTIONS:

31. What is the depth of water at high tide at a point 700 M across the river?

    a. 9 M

    b. 4 M

    c. 13 M

    d. 6 M

32. What was the bottom material at a point 400 M across the river?

    a. sand

    b. grass

    c. mud

    d. rock

33. What was the temperature of the surface water at a point 500 M across the river?

    a. 50^{o}

    b. 80^{o}

    c. 20^{o}

    d. 70^{o}

34. What is the salinity of the surface water at a point 800 M across the river?

    a. 27 ppt

    b. 33 ppt

    c. 32 ppt

    d. 25 ppt

35. The salinity was lowest at what point across the river?

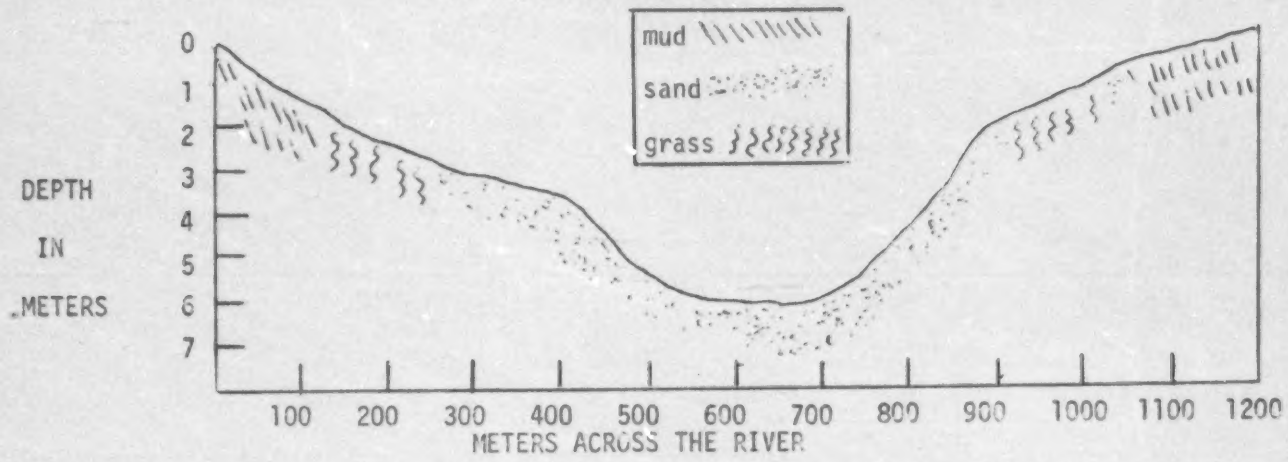
    a. 100 M

    b. 1000 M

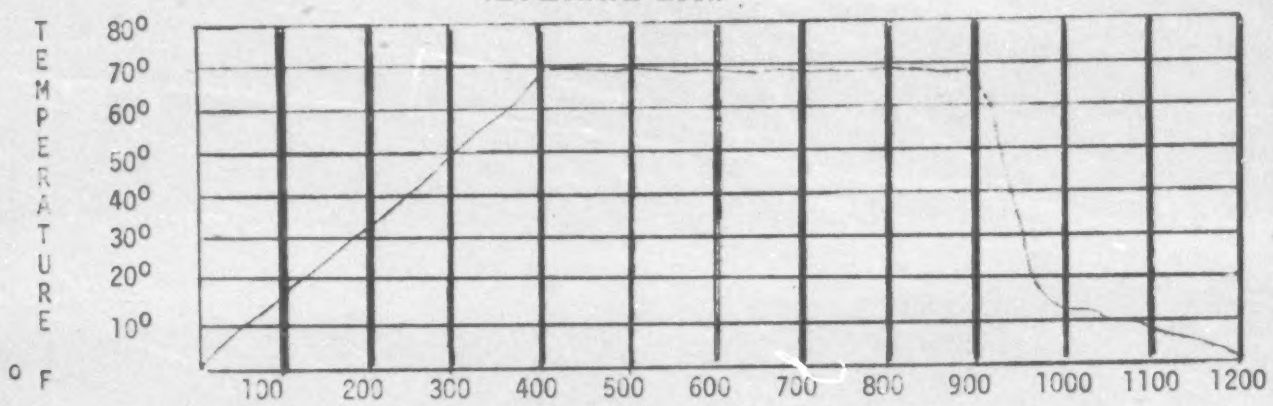
    c. 500 M

    d. 1200 M

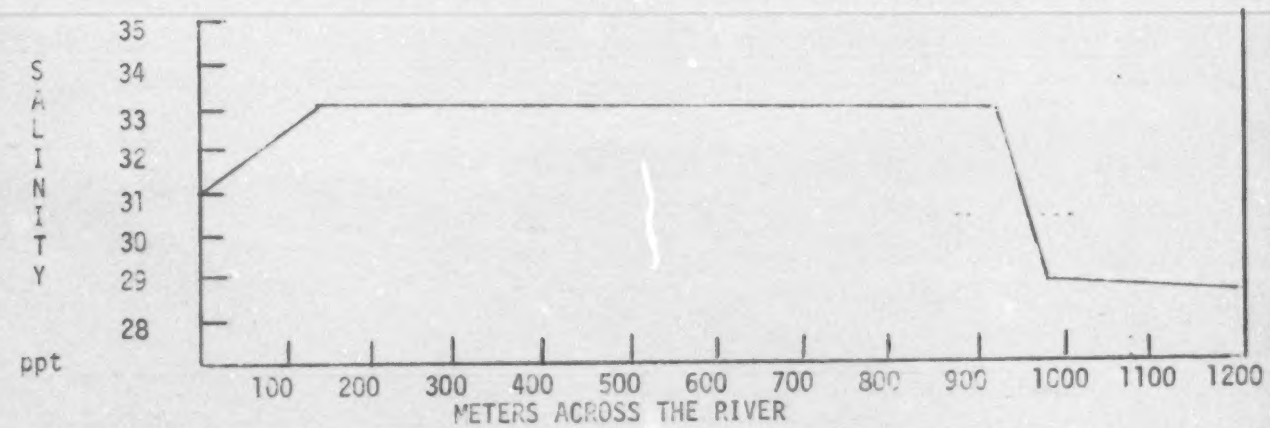
BOTTOM TYPE & DEPTH CHART



TEMPERATURE CHART



SALINITY CHART



Data Test (cont'd)

USE THE CHARTS ON YOUR ANSWER SHEET TO ANSWER THE FOLLOWING QUESTIONS:

36. Students, while doing a profile study of the river, were to find certain physical factors at five locations. Plot the following data on a chart:

Location	1	2	3	4	5
Water temperature in degrees F.	86°	85°	84°	85°	90°

37. Plot the salinity data at each of the five locations.

Location	1	2	3	4	5
Salinity, ppt	35	33	33	33	35

38. Make your own depth chart from data collected at the five locations:

Location	1	2	3	4	5
Depth of water in centimeters	90	110	190	120	90

39. Make a chart when given average air temperatures at the five locations.

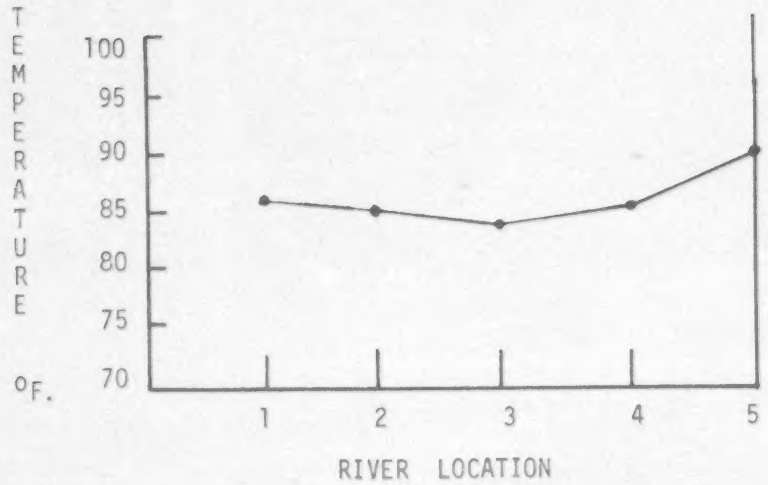
Location	1	2	3	4	5
Air temperature in degrees F.	80°	82°	86°	88°	78°

40. Now see if you can plot two physical factors for each of the five locations on one chart?

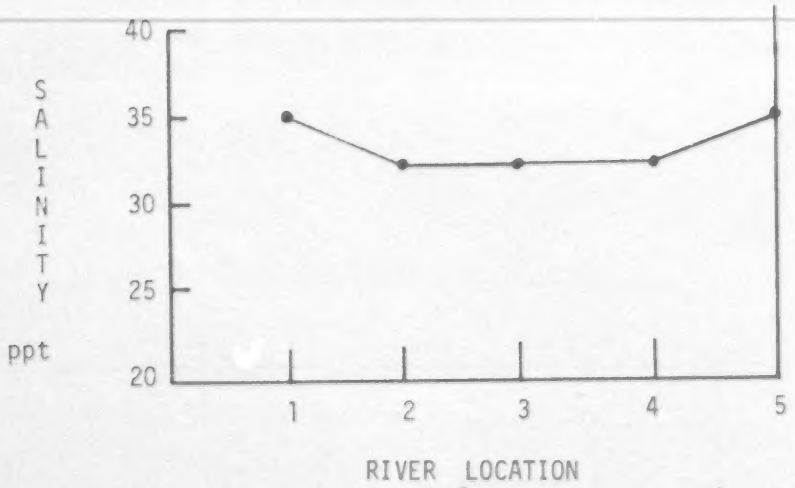
Location	1	2	3	4	5
Water depth in centimeters	90	110	190	120	90
Water temperature in degrees F.	86°	85°	84°	85°	90°

TEST KEY

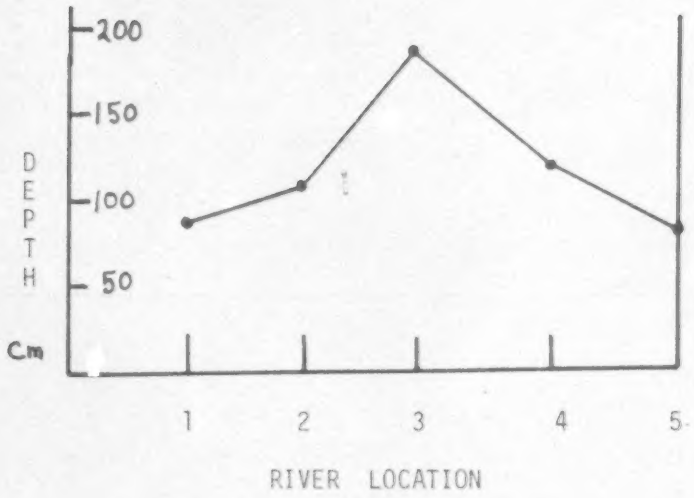
1. a
2. c
3. b
4. b
5. c
6. c
7. a
8. d
9. c
10. d
11. b
12. d
13. a
14. c
15. d
16. c
17. b
18. b
19. c
20. a
21. a
22. b
23. b
24. d
25. a
26. a
27. b
28. d
29. b
30. c
31. d
32. a
33. d
34. b
35. d



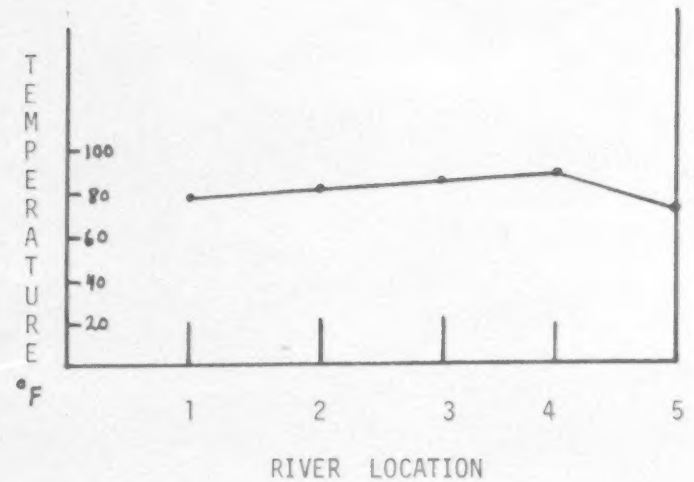
Question 36



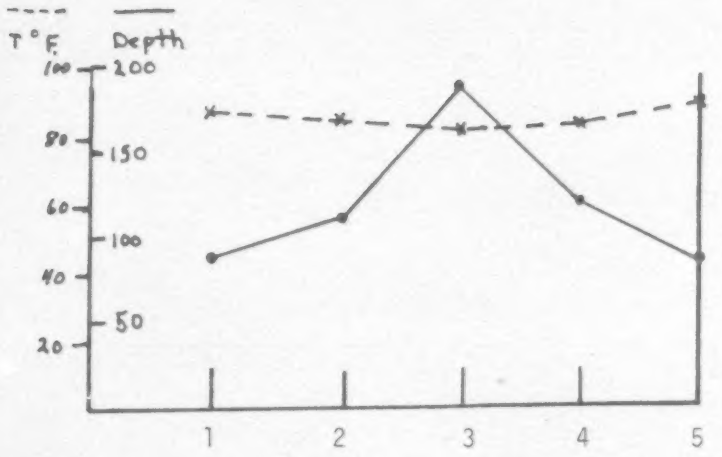
Question 37



Question 38



Question 39



Question 40